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To EDWIN A. START

Secretary American Forestry Association

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Dear Sir: I hereby signify my desire to become a member of the American Forestry Asso ciation. One dollar (\$1.00) for annual dues is enclosed herewith. Very truly yours.

Name

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Valley Land Stripped of Soil by the Freshet of May 21 and August 6, 1901. McDowell County. North Carolina

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THE BATTLE FOR THE WEEKS BILL

NOTHER milestone was passed in the long march toward a truly national forest policy on Wednesday, February 23, when a hearing was given before the House Committee on Agriculture on the bill for the creation of national forests, known as the Weeks Bill, and popularly as the Appalachian Forest Bill. No attempt was made, as in former years, to secure a large attendance at this hearing, or to make a popular demonstration. three years this had been done, and the convictions of the people and the organizations of the country are well established, and equally well known. This hearing was devoted principally to the examination of three expert witnesses, and it is no reflection upon earlier hearings to say that the case has never had a stronger presentation. The sessions opened in the morning and were continued in the afternoon, and there was a good attendance of the committee at both sessions. Since the opinion of the Judiciary Committee of the House of Representatives two years ago has made it necessary to consider this question with reference to its bearing upon the navigability of streams, the testimony was concentrated mainly upon that point, and peculiar interest was given to the discussion coming from distinguished scientists who have thoroughly studied the question with which they were dealing, in view of the fact that these men unanimously controverted the conclusions of the re-

port recently made and widely circulated by Willis L. Moore, chief of the Weather Bureau. The three experts who appeared were George F. Swain, professor of civil engineering. Harvard University; L. C. Glenn, professor of geology, Vanderbilt University, and Prof. Filibert Roth, the head of the Forest School of the University of Michigan. Thus, with an engineer, a geologist, and a forester, all of whom stand in the first rank of their professions, the case had a broad and able consideration. Mr. Moore's contention that "forests should be preserved for themselves alone, or not at all," and again that "the run-off of our rivers is not materially affected by any other factor than the precipitation," was declared by the three gentlemen named to be not substantiated, and some of his conclusions were said to be ridicu-

Charles F. Scott, of Kansas, chairman of the committee, presided, and the case was opened for those who appeared in behalf of the bill by Frank D. Currier, representative from New Hampshire. Mr. Currier introduced Andrew J. Peters, representative from the eleventh Massachusetts district, one of the Boston districts. Mr. Peters voiced the intense public interest of New England in this matter, naming a long list of business and other organizations which have endorsed and are urging the passage of the bill. He declared that New England has paid her



Hon. John W. Weeks, Representative from the Twelfth Massachusetts District

share cheerfully for the forest reserves of the West, affecting watersheds which produce only three per cent of the developed water-power of the United States, while those of New England affect thirty-seven per cent. He urged the commercial importance of the White Mountain forests, and closed with an urgent appeal in behalf of the people of New England for this generally demanded legislation.

Mr. Currier said that New England was deeply interested in all conservation matters, and her people were willing to pay their share, but feel that they are not being treated fairly when their needs are overlooked and all of the money is spent in the West.

The first of the experts to speak was Professor Swain, who represented the Boston Chamber of Commerce, the Massachusetts Forestry Association, the Society for the Protection of New Hampshire Forests, the Appalachian Mountain Club, and other organizations. Professor Swain is one of the best-known engineers in the country, of recognized authority and wide experience. He has given much study for years to the effect of forests upon stream-flow, the question to which he turned his special attention. Referring



After Logging. White Mountains, New Hampshire

to the much-discussed papers of Professor Chittenden and Mr. Moore, he said that they did not affect this case. We do not favor forests on lands better suited for cultivation, but on land that is not suited for cultivation. The first part of Mr. Moore's report dealing with the effect of forests upon rainfall is comparatively unimportant because little stress is laid upon this aspect of the question by advocates of forest maintenance. Discussing the effect of forests upon floods and erosion, Professor Swain cited eminent German authorities. He made it plain that this is a matter that is dependent upon variable conditions. Floods are due to rainfall

and snowfall which are not determinable even by long series of observations. We are thus thrown back upon common observation and fundamental principles. The regulative effect of the forest reservoir is upon average flood conditions rather than on extremes. That a great flood may sometimes occur in a forested country is no more a reason for disregarding forest protection than is the occasional occurrence of a great conflagration in our cities a reason for discarding the usual means of protection against fire.

The speaker cited the French authorities Belgrand and Vallés in support of forestation for the prevention of ero-



Hon, Frank D. Currier, Representative from the Second New Hampshire District

sion. In making this citation, he showed that these authorities had been misused by Mr. Moore, who cited them in He also compared Mr. his report. Moore's citation of Lauda with the actual statement of the latter in his paper at the Milan conference on inland navigation. He introduced in evidence the opinion of the eminent French scientist, Professor Vélain, of the Sorbonne, to the effect that the Seine flood was in part due to the denudation of the watersheds of the Seine and its tributaries. In regard to Mr. Moore's seventh conclusion, that the run-off of rivers is not materially affected by any other factor than precipitation, Pro-

fessor Swain said that this is evidently ridiculous, since every one knows that the slope of ground, character of soil and of rock, and the elevation affect the flow from the surface. With reference to Mr. Moore's conclusion that floods or droughts are not affected by the forests, he called attention to the fact that, inasmuch as forest cover retards the flow of water from the surface of the ground in summer time and also retards the melting of snows in the winter time, it must be clear that in general the forests regulate, and maintain the even flow of streams, although they may not affect the greatest floods and droughts, which occur only at consid-



After a Fire in the Slash. White Mountains, New Hampshire

crable intervals. He called attention to the fact that Mr. Moore arrives at no conclusion with reference to erosion, which is one of the most important clements affecting the navigability of streams. He also pointed out clearly that the extreme high and low-water stages were important in this connection.

In conclusion, he urged that while it is argued that no serious results have as yet followed deforestation in this country, the people believe in prevention, and they hold the idea—and in the main it is correct—that forests do affact the storage and run-off of the

streams. Furthermore, while this measure calling for national acquisition of forest land must rest, so far as present decisions are concerned, upon the effect of the forests upon navigation, there are other important considerations such as the water-powers, the commercial value of the forests themselves, their influence upon health, and their beauty, which, while they are aside from the legal powers of Congress, add to the value of such action as is proposed, and should increase the willingness of Congress to take such action when it is clearly shown that these forests upon the steep slopes have an ef-



An Erosion Gulley After Logging. White Mountains, New Hampshire

fect upon navigation which gives constitutional warrant for the enactment of this measure.

Some questioning followed on the part of members of the committee, and Mr. Currier brought out the fact that a bar has been forming for several years near the mouth of the Connecticut in Long Island Sound which has been found to be composed largely of granitic sand, which could only have come from the White Mountain country.

Professor Glenn, of Vanderbilt University, who has appeared in these hearings in previous years, is always an in-

teresting witness because of his accurate scientific knowledge and because of his intimate personal acquaintance with conditions in the Southern Appalachians. For four years as a geologist in the employ of the North Carolina Geological Survey, the United States Forest Service, and the United States Geological Survey, he traveled on horseback and on foot through the whole Southern Appalachian country, living with the people and becoming acquainted at first hand with all the conditions. He showed that deforestation, Mr. Moore to the contrary notwithstanding, does increase both the fre-

quency and the height of floods by eroding the steep slopes and thereby conveying the water more rapidly to the streams and at the same time filling them with sand and making them less capable to carry it away. He showed that deforestation decreases the lowwater flow, making it lower than under forested conditions, and gave numerous concrete examples of this effect. He further showed that the eroded waste filled the stream channels and worked its way down stream, filling the reservoirs of power plants and destroying their value, and ultimately filled the navigable streams, ruining much of the improvement work of the army engineers. Dredging, for instance, has to be repeated time and again, while gravel deposits are steadily filling the rivers and harbors. The better policy would be to prevent waste from entering the streams by keeping the steep mountain slopes forested. Professor Glenn showed how streams so protected scour themselves and are rarely subject to filling, while streams whose watersheds are denuded gradually have their channels silted up and are able to carry less water, and are therefore much more subject to floods and low water. He also showed that much valuable land has been ruined in the South by floods carrying gravel and sand over the rich bottom-lands and reducing to waste thousands of acres that were formerly among the most valuable agricultural lands of the southern country. Conditions are rapidly becoming worse and the people support eagerly the proposed legislation, and are demanding it as the most vital thing for them now before Congress. Professor Glenn, personally, does not think highly of the proposition to regulate Southern Appalachian streams by storage reservoirs, regarding reforestaton as preferable in many ways.

Chairman Scott had interpolated several questions during Professor Glenn's statement, these questions relating especially to the farm lands on the lower slopes of the mountains, which Mr. Scott holds are the chief sources of ero-

sion. Professor Glenn said that many of these farm lands should never have been so used, not being suited for cultivation. He had found fields cleared and cultivated on slopes of thirty-seven degrees, measured by clinometer. Such slopes are altogether too steep for cultivation. The problem in the Southern Appalachians is both an agricultural and a forestry problem, which can only be solved by reforesting the steep slopes and saving the gentler ones by terracing, ditching, and better cultivation. But the proportion of suitable agricultural land is not over twenty per cent of the area of the mountain country, as against at least eighty per cent which is profitably available for forest growth only. The statement of Mr. Moore that more of these slopes should be cleared would be followed by disaster if carried out under present methods of cultivation. He showed that while the source of flood damage is on the upper slopes, the actual damage is done when the water strikes the gentler slopes where the run-off is not so rapid. The headwaters, so far as flood water and erosion are concerned, are the locus of the chief destruction. Deforestation does increase the height and frequency of floods; there can be no doubt about

Professor Glenn was the last speaker at the morning session, and the committee reconvened at three o'clock in the afternoon, when Professor Roth, of the University of Michigan, was the first witness. Professor Roth stands in the first rank of American foresters in point of wide experience and professional knowledge. He showed several photographs, reproductions of which appear in connection with this report, illustrating the effect of deforestation in the Southern Appalachian and White Mountains. Mr. Scott took exception to one of these photographs on the ground that it showed conditions in the low rolling country rather than in the mountains. Professor Roth argued that photographs were not reliable so far as slope was concerned, and that the conditions illustrated there



Logging Operations on the North Spur of Chocorus Mountain, White Mountains, New Hampshire



Abandoned Pasture on Tributaries of Cane Creek. Several Small and Several Very Deep Gullies Are on This Land
Mitchell County, North Carolina

were such as would exist on the steep slope. Representative Weeks of Massachusetts, who had taken charge of the hearing during the morning when Mr. Currier had to attend a hearing of his own committee, suggested that so far as the nature of the land was concerned, its selection depended upon the judgment of the Geological Survey. A general discussion arose at this point, participated in by Messrs. Scott, Lamb, Currier, Plumley, and Roth, in regard to erosion, slopes, and farming. When Professor Roth was again allowed to proceed he urged that it is worth something to know that the people of Europe, who have fought this question all over, believe in the influence of the forests upon stream-flow, and without exception have laws regarding the maintenance of protective forests. He also called attention to the fact that Congress, in 1807, was largely influ-

enced by the fact that the western forests were generally believed to have a beneficial influence upon the flow of water of the western states, making them important in the irrigation work, He then pointed out the fact that upon the main issues there was general agreement among scientists, engineers, and others, as well as among the people of our country; that it was generally believed that forests were especially important in holding the soil on the slopes of the mountains, keeping it in a retentive condition and retarding the ramfall by preventing gullying, the gullies being in the nature of under-drains or ditches in which the water rapidly collects and rushes away. He called attention to the fact that the forests a: the present time appeared to be the only feasible and economic means of regulating the flow of our navigable rivers; for artificial reservoirs, the only



Eroded Slopes, Western North Carolina

alternative thus far suggested, would destroy railways, highways, and other existing improvements; would prevent the use of valleys, converting them into lakes and reservoirs, and in many cases such artificial regulation of the streams would endanger life and property, besides requiring enormous sums both to construct and maintain; and that in all probability such artificial means would come to nothing if the forests were allowed to be devastated and the mountains converted into waste land such as are already seen in parts of the Appalachians, both North and South. The most important opinion advanced by Professor Roth was that the forests are the only means of holding soil and regulating stream-flow which can at once be established and are already established through probably more than eighty per cent of all these lands, only requiring attention by proper protection and use. In contradiction of the

claim that all these forest improvements and protection would require unusual expenditures running into the hundreds of millions of dollars, Professor Roth clearly showed that these lands, when purchased, could be generally protected and forests maintained upon them for all time, and at the same time the forests would become in a few years not only self-supporting, but paying for themselves, so that the expenditure upon the part of the people would become actually an investment. Professor Roth emphasized the fact that he was willing to stake his reputation and stand by the committee if they voted favorably upon this bill, and he believed that the people at large would do the same thing.

Mr. G. Grosvenor Dawe spoke for the Southern Commercial Congress, of which he is the managing director. He said that the business element of the South expects action; that seven of



Deep Gullies Washed in An Old Field, Long Cultivated in Corn. and Abandoned When Soil Became Thin. Scattered Reproduction of Hardwoods and Pitch Pine, but Not Sufficient for Protection. Jackson County, North Carolina

the states in which government action is expected have passed the necessary enabling acts, the matter being of such importance as to overcome their state'srights scruples. This action on the part of a number of southern states is sufficient notification to their representatives in Congress to support this measure, and that they expect constructive action following their own. There is a new progressive business spirit in the South, he said, which is not bound by party lines and which looks not alone to the present revenues, but rather to the welfare of the South for the later generations as well as the present one. No statesmanship which does not include this view is constructive, and the South stands for constructive statesmanship. He particularly deplored destruction of the forests by non-resident owners who acquired the lands in the

mountains for cheap prices and are now robbing the South of its natural resources. He urged the committee to consider the question broadly and to make a favorable report.

In closing the presentation of the case. Mr. Weeks made a plain and forcible statement. He explained certain details of the bill in which it differs from that of last year. These are chiefly in the removal of all references to the existing national forests and the income from them, making the appropriation direct from the Treasury, and in the reduction of the life of the bill from nine years to five years. Weeks urged that Congress should certainly have confidence in the Geological Survey upon the scientific judgment of which decision as to the purchase of these lands would ultimately rest, and that, if the Survey could not be trusted,

it should be reorganized. He believed that this was a sufficient check upon the expenditure for the purpose of the bill. He offered a homely illustration from his experience as a boy on the farm in northern New Hampshire as a further contribution to the discussion of Mr. Moore's report. He said that on the hillside pasture the snow would be gone in the spring so that one could walk in thin shoes, when the snow was lying a foot and a half deep in the woods just above the pasture. It is a matter of common observation which needs no scientific knowledge, he pointed out, that if the trees were cut off from this land it would be in the same condition as the pasture adjoining.

Finally, Mr. Weeks urged upon the committee that it is not new legislation. and that it would be gross injustice not to report back to the House a bill which has in susbtance passed the Senate twice and the House once. To prevent action on this bill would be resented by Massachusetts and by all New England. The bill is moderate in character and, in my mind, he said, will start a policy that will be of great benefit to the whole country. He urged prompt action, and said that hundreds of thousands of people all over the country were behind this measure, that it had been advocated by President Roosevelt, by President Taft, and is the one practical measure that has been offered in the direction of carrying out the conservation policy.

Mr. Currier made no formal speech, but supported his colleague effectively with pertinent suggestions and facts.

This report necessarily gives a very inadequate impression of the able presentation of the case to the committee.

The interchange of question and answer, the keen and unassailable scientific arguments advanced by Professors Swain, Glenn, and Roth made the hearing a notable one in the history of the campaign in behalf of the Appalachian forests. Chairman Scott, at the outset of the hearing, requested the members of the committee to refrain from interrupting the speakers with questions until they had concluded their statements. Within a few minutes after this he himself interrupted the first speaker and he continued this practise of interruption with questions and interpolation of his own views, especially in the afternoon, when Professor Roth This interfered with was speaking. the orderly presentation of the argument which Professor Roth prepared, but perhaps it did not interfere with the effectiveness of the discussion, as Mr. Scott's questions were adequately answered. Mr. Scott's well-known opposition to this measure has not in the least abated and is plainly shown in his conduct of the hearings. Indeed, he appears at times more anxious to bring out his own theories, some of which are well defined, than to hear the uninterrupted statement of the expert witness.

The general interest of the committee was shown by the good attendance and keen attention to all points brought out in the discussion.

Mr. Moore's position previously taken before the same committee was so badly riddled by the discussion that the committee considered it necessary to give him an opportunity to take the stand in his own defense, and a special hearing was assigned for that purpose for the 1st day of March.



GROWING OAK TREES

By EDWARD W. HOCKER

It IS no easy task to enlist the support of farmers and other land-owners in an undertaking the profits of which cannot be realized until after the lapse of a century or more. But some such undertaking is necessary if the oak and other American hardwood

wider variety of purposes than any of the others, usually is not available as timber for a period varying from 120 to 200 years after the acorn has germinated,

Poets sing about the stanch old oak; and there is something venerable, some-



Charles S. Mann and His Beds of Oak Seedlings

trees are not to become so rare as to forbid their use for the practical purposes they now serve.

Everywhere throughout the land the increasing scarcity of the various kinds of hardwood is lamented. Prices are rising at an alarming rate, and it is evident that the quantity consumed yearly is three or four times as great as that which becomes available from growing trees. Now, the hardwoods nearly all come from slowly growing trees; and the oak, which serves a

thing well-nigh sublime, about an ancient tree of this variety. Poetry and veneration, however, will not prevent the oak from becoming extinct. A campaign of education must be commenced in behalf of the systematic growing of oak trees.

Under the auspices of the national government and of some of the states, attempts have been made to foster the growing of slowly maturing trees in the forest reserves; but thus far few individuals have been willing to de-



How Some of the Rarer Kinds of Oak Seedlings Are Grown on the Mann Farm

vote much serious attention to the planting of trees solely for posterity. Therefore, an instance of that kind in Pennsylvania, where a farmer of moderate means is exerting himself by example and by advice to further the planting of oak trees, merits attention because it is an altogether altruistic endeavor.

Somewhat more than fifty species of the oak grow in the United States, and about twenty-five are found throughout the northeastern portion of the country. On his Arbormeade Farm, in Horsham township, Pennsylvania, fifteen miles north of Philadelphia, Charles S. Mann is growing not less than thirty species of the tree, some being represented by hundreds of small trees, while of others there are only a few experimental specimens. Moreover, it must be borne in mind that Mr. Mann is not a nurseryman, and is not growing trees for profit. He is what is usually termed a "small farmer," just like the average tiller of the soil throughout the coutry. His undertaking in oak-growing is the outcome of his intense love of the study of forestry, his realization of the great havoc wrought in the forests of America, and his zeal to encourage his fellow-farmers to grow oak trees.

Ten years ago he began planting oak trees. Thus to-day none of his trees is of great size, save a few that stood on the farm long before he took up his special work. A space of several acres about his house is his field of opera-The common varieties that are to be found in Pennsylvania are growing in large beds, and the trees vary in size from a few inches to six or seven feet. These include the pin oak, which grows faster than any other oak and sometimes matures in seventy-five years; the white oak, the black oak, the red oak, the scarlet oak, which is particularly beautiful in autumn; the mossycup or burr oak, which has the



Th: Tree-embowered Mann Homestead

largest leaves and acorns; the live oak, the willow oak, the post oak, and some others.

Rarer varieties whose adaptability to the climate is still a matter of doubt, are planted in boxes or in discarded tinware. They are screened with wire to protect them from marauding animals, and during inclement weather can be removed to shelter. Among the varieties thus grown are the blackjack oak, the rock chestnut oak, the southern water oak, the Bartram oak, the southern laurel oak, the Texas red oak, the holly oak, the Sterling or cleft-leaf rock oak, the cinnamon oak, the blue jack oak from Texas, the California black oak, the mountain oak, the Hooker oak, a weeping white oak from California where the tree has a spread of 150 feet and is more than 100 feet high; the Texas live oak, the chinquapin oak, a western dwarf that grows like a bush; the shingle or northern laurel oak; the overcup oak, the Spanish oak, and the turkey oak. Besides these American oaks, the English and the golden oak are also represented.

Nearly all these trees were grown from seeds which Mr. Mann either gathered in the woods or procured by writing to persons at a distance who are interested in forestry. Through correspondence he has obtained seeds from twenty-seven states.

A striking evidence of Mr. Mann's enthusiasm is the fact that he is replacing his apple orchard with an oak grove. San Jose scale has wrought havoc among the apple trees during the past few years, and they are of little value. So Mr. Mann is transplanting oak trees from his beds to the orchard.

Mr. Mann is striving to arouse the cooperation of school children in his tree-growing project. He is a member of the township school board, and he has planted oak trees on the grounds of several schoolhouses and has also placed attractively arranged collections of the leaves of the various species of oak trees in schoolhouses. Explain-

ing his endeavor, Mr. Mann says: "An inborn love for plant life, especially in its highest forms, shrubbery and trees. induced me to attempt to make a collection of native timber and ornamental Like many another 'small farmer.' I could not afford to buy them at fancy prices, so I thought out a plan of procuring the seeds and planting them. Such seeds as I had I could change with other tree fanciers for some sort that I wanted from other parts of the country, and so not merely supply my own wants but grow enough to spare to any one who should care to adorn school grounds, roadsides, and

home grounds. "I hoped and believed that the surest way to draw the attention of the people to this most useful branch of nature study would be by planting trees that would show by comparison and contrast the marvelously rich and varied assortment of our beautiful indigenous trees which have never yet been fully appreciated, but have always been wasted and destroyed. I wanted to make some attempt, however small, to save some of the great quantities of forest-tree seeds that annually go to waste unnoticed throughout the land, which, for climatic as well as for economic reasons should be saved and planted to provide the millions of seedling trees needed to reforest the lean, bare, rocky and untillable hillsides and mountains of Pennsylvania and other states. For the great work of the national and the state forest service must be supplemented by the individual efforts of every public-spirited landholder.

"I would especially like to get the teachers and pupils of the public schools interested in this cause—to help them all to admire, study, protect, love and to some extent propagate our most useful and beautiful trees in connection with the school-garden movement, beginning by collecting and plauting such seeds as they could find at home and on the way to school.

"The underlying motive of my work has not been for pecuniary gain, but nevertheless I believe it will always pay well to produce trees whose age and ante-

cedents are known.

"In many parts of the central West the noble hardwoods are in danger of extermination. Of some of the more rare and valuable sorts, like the shingle, the overcup, the Spanish and the chinquapin oak, the elms, hickories, and pecans, there are not enough left to perpetuate the species. And it is high time to take heed lest the more common varieties suffer a like fate."

Though Mr. Mann centers his efforts upon the raising of oaks, he is likewise growing specimens of almost all native trees of North America. Indeed, his love for trees is so predominant that the ancient farmhouse wherein he lives is almost concealed from view on all sides by trees. This house was built in 1754 by John Mann, one of the Scotch-Irish settlers of Pennsylvania, and the property has been in the possession of the Mann family uninterruptedly for 160 years.



FOREST PROBLEMS IN THE PHILIPPINES

By BARRINGTON MOORE, M.F., United States Forest Service

[Continued from the February number]

IV-HOW PROBLEMS ARE BEING SOLVED

T IS with great pleasure that we turn from the consideration of the problems to a brief sketch of the fine work which is being done to solve them. All the strictly botanical work has been very wisely turned over to the Bureau of Science, which describes and classifies the specimens sent in to them by the Bureau of Forestry. The Bureau of Forestry collects enormous quantities of specimens, generally a large section of the tree and leaves, together with the fruit wherever possible. On each specimen is placed a serial number. This number is always mentioned in any future reference to the specimen and serves as a sure means identification. The Bureau of Science keeps a careful record of all the information on a card catalogue system and sends back to the Bureau of Forestry such data as is necessary. In the Bureau of Forestry hand specimens of all the species identified are kept on shelves, arranged alphabetically by families, genera, and species, so that it is possible to pick out any desired This botanical work species instantly. of the Bureau of Science, requiring, as it does, a systematic botanist of the highest skill, has been done so well that it is acknowledged to be better than any botanical work heretofore done on tropical trees in the world.

In addition to this strictly botanical work of the Bureau of Science, an ecological study of the whole forests of the Philippines is being made by the chief of the Bureau of Investigation. who probably knows as much about the ecology of tropical trees as any man

living. This invaluable work, when complete, will be unique of its kind.

The properties and uses of the woods identified is so carefully and thoroughly done, that even those species of rare occurrence are worked up, because they may be found to be of value for some special purpose, such as tool handles, etc., so that it will pay to go long distances in the forests for a single

As regards silviculture, practically nothing has been done so far, on account of the smallness of the force and the pressure of other work, demanding more immediate attention. However, a beginning is being made by the drawing up of a plan for a system of sample plots. This work is to be done by a man of wide experience with sample plots in the United States, and will doubtless lay the foundation of a thorough silvicultural study of all the trees of the islands.

As regards the problem of population, the need for fuel and building material has been met by the setting aside of any small bodies of forest which a community may apply for, to be devoted solely to supplying the needs of that community. This is an a laptation of the system used with more or

less success in parts of India.

As far as Caingins are concerned, it is unfortunate that very little can be done at present. Although the bureau is making strenuous efforts to stop them, the smallness of the force at its disposal, the large areas of undemarkated forests which if has to look after, and, above all, the lack of support from headquarters, make the task an impossible one. As soon, however,

as the forest reserves are established and a force organized, the forests will be protected against Caingins as against

other destructive agencies.

Cogan or grass lands cannot be utilized until the government clears up the invalid Cacique claims to it. This could be done by a properly-collected land tax, which would immediately cause them to drop their claims, because the land is of no use to them and they are all land-poor; or, preferably, by laying off the whole of the islands into townships, sections, quarter-sections, and forties, as with the public domain in the United States, and making every-

body prove up his claim.

The attempts at making a survey of the islands have so far been worse than They have consisted in maps of occasional isolated small fields made by the Bureau of Lands, for the purpose of marking the boundaries, each map being made separate, so that it will be impossible to tie them together. This is costing considerable sums of money, which is all wasted, because the work will eventually have to be done all over again. The only solution of this problem-a solution suggested by men who have been in the islands for some time and have given the matter considerable thought—is for the government to "grasp the bull by the horns" and have the United States Geological Survey send a party over to do it properly, once for all. This was advocated by President Roosevelt in a special message to Congress, but the commission refused to have it done, perhaps because they thought they could do it without outside help.

For the regulation of the taking up of homesteads, a sound scheme, suggested by a member of the Bureau of Forestry, is that certain bodies of land suitable for cultivation should be selected by the Bureau of Forestry and notifications sent around to the people of the neighborhood, so as to give anybody desiring a homestead a chance to send in an application. Then all these applicants could be moved bodily onto the land. The advantages of this scheme to the people themselves would be two-

fold: First they would be kept together in a community, which is the way they like to live; secondly, the haphazard, hit-or-miss element of the ignorant individual picking out a piece of land would be obviated. Of course, this would also enable the Cogan lands to be settled up where cultivating them did not involve too much hardship.

In utilizing the forests the most astounding progress has been made from a lumbering point of view. From the silvicultural point of view, it is unfortunate that conditions have forced the bureau to open up the forests so rapidly before more was known about how to cut them. But, considered broadly, the opening up of the forests, though perhaps not such a rapid opening, is the essential preliminary to their future management, without which nothing can be done, so that the amount of loss suffered in the beginning will be more than repaid in the end.

For the control of logging operations, certain logging rules have been laid down by the bureau in each case, so as to do as little injury to the forest as possible. For example, the rules for the Cadwallader concession in Bataan Province, on Manila Bay, are in sub-

stance as follows:

General, for agricultural and non-agricultural land.

I. Forest on land below 500 feet elevation can be cut clean, because this land is considered agricultural.

2. Timber cut, used, or wasted in violation of the cutting rules,, or forest regulations, is to be paid for.

3. Tops, etc., are to be used for fire-wood wherever practical.

4. Felling is to be done with saws as far as possible.

5. No trees are to be left lodged.

6. No stumps are to be higher than the principal buttress, or, without buttresses, than the diameter of the tree on the stump.

7. Defective logs with fifty per cent or more of clear, sound timber shall be

utilized

8. Minor products shall be gathered if possible.

Cutting rules for non-agricultural land:

1. Diameter limit of forty centimeters (fourteen inches) breast height for Lavan, Apitong, Panao, Giujo, Tanguile, or trees of the first group.

2. All sound trees of other species may be cut, and those of more than seventyfive centimeters must be cut and

utilized.

3. None of the above-mentioned species or first group woods shall be used for logging construction, except with the special permission of the forest officer in each case.

4. Workmen must not destroy seedlings of the above-mentioned species

or first group.

The chief objections to these rules are that, firstly, it is unwise to clear-cut a part of the forest for agricultural land when it is not needed for settlement and may not be needed for a good many years. Secondly, the diameter limit of fourteen inches is far too low. A limit of twenty-four inches would not cause much loss to the lumberman and would save some fine young poles.

The concessions taken up are being worked with characteristic American enterprise. On two concessions logging railroads have been run up into the forests and regular stream logging, hauling the logs to the railroad by donkey engines, is being carried on. On one concession, that of the Insular Lumber Company, the operations are an exact copy of the lumbering operations of a large company in Seattle, Wash., and the sawmill, of 100,000 board-feet daily capacity, is as thoroughly fitted up with up-to-date appliances and as well run as almost any mill in America. It must be remembered that all this is a new venture, believed to be utterly impossible a few years ago. It has rendered not only possible, but profitable, the utilization of the large quantities of Diptocarps, until recently considered practically useless.

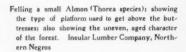
We now come to the keynote of the whole policy of the bureau—the establishment of forest reserves. Until recently the necessity for doing this was not fully realized. Hence, with the exception of one small reserve at Limao, across the bay from Manila, none has

so far been established.

Since the policy was started preliminary work has occupied the entire attention of the bureau. It was first necessary, of course, to locate the forests before asking to have them reserved. This work consists of making a thorough reconnaisance survey of the whole islands, a very difficult undertaking. The only maps they have to begin with are what are called compilation maps. These are the regular coastguard maps (giving merely the coast line and an occasional prominent peak), on which they have put all the streams and villages which are known. They must have as many names of villages as possible, so as to be able to tell the cargidores (Filipino carriers) where they are going. Because the native will not start off so many miles in such and such a direction, but must know that he is going toward some village he has heard of. Often he will not go at all, thus creating a serious difficulty in this kind of work. The coast-guard maps are accurate enough with regard to the coast line itself, but are sometimes away off in giving the width of the islands. For instance, the northern part of the Island of Luzon was found to be six to ten miles wider than the coast-guard map gave it. Hence, they can be used only for putting in the forests along the coast. For the interior of an island they go through lengthwise and crosswise as many times as is necessary to cover it all, keep trail notes by hand compass and pacing every foot of the way. These notes are plotted on crosssection paper in the field on a scale of I to 10,000. The sheets are sent in to the bureau and put onto the final map on the scale of 1 to 100,000. The forester who has done most of this work has wisely made the rangers keep the trail notes themselves, believing that it is better to have them learn to do it, even though it may not be done quite so well at first, because, when once they have learned to do it, it is easier to do



A fair-sized Panao (Dipterocarpus verniciflus) on the Cadwallader Concession in Batana Province, at about 700 feet elevation. This picture also shows the all-aged character of the forest







Donkey Engine and Yard at the Head of Logging Railroad. Insular Lumber Company Concession. Northern Negros

it right than to do it wrong. He himself examines the forests and collects specimens, sometimes as many as twenty a day. By this policy he is breaking in a force of useful rangers which he turns over to the administrative branch, with the exception of a few whom he retains to help break in the new ones next season. Considering the rough method used, this work is done with astonishing accuracy, more than ample for the purpose. They have already covered most of the important islands in this way. With this data in hand, at any conference or public meeting they can show facts and results. They can make the people see that they are doing some work and know what they are talking about. Thus half the battle for the reserves is won already. To summarize the work being done:

I. The work of describing and classifying the flora of the forests excels any work in the systematic botany so far done in the tropics. An ecological study of all the forests of the islands is being made by the chief of the Branch of Investigation.

2. The investigation of the properties and uses of the different woods is being carried on with greater thoroughness than has ever before been done with tropical woods.

3. The foundation has been laid for a careful silvicultural study of the trees

4. Concerning the relations of the forests to the population and the settlement of the land: (a) The question of supplying the needs of the local population for firewood and building material has been solved by the formation of communal forests devoted solely to this purpose; (b) strenuous efforts have been made by the men in the Bureau of Forestry to prevent Caingins, but have been in vain on account of the smallness of the force, the indefiniteness of the areas, and the lack of support from headquarters; (c) nothing can be done with regard to settling up the Cogan lands until the invalid claims of the Caciques have been cleared up by the government; (d) toward obtaining a survey of the islands, nothing has been done, but the worse than useless dabbling of the Bureau of Lands; (e) a suggested plan for the regulation of homesteads is to have the land picked out by the Bureau of Forestry and a number of people moved on to it bodily as a community.

5. The forests have been opened up by the most up-to-date American method of logging controlled by log-

ging rules.

6. The establishment of forest reserves has been taken as the keynote of the whole policy of the bureau, and the preliminary work is being pushed with the utmost vigor.

7. The money for starting a rangers' school has already been appropriated

by the assembly.

V-AN OPENING FOR AMERICANS

All these most interesting problems present a splendid opportunity for Americans of the right sort to do some work which is sure to be of benefit to the islands and so, indirectly, to their own country. Of course, it would be useless to deny that the climate is less favorable for active work than that in the states. This only means, however, that a man must take better care of himself in the Philippines to keep in ordinary good health than he would have to do in the states. If he does take care of himself, there is no reason why he should suffer in the slightest from the difference in climate. course, the government will, sooner or later, have to open its eyes to the fact that if it wants a continued supply of good men, it will have to offer higher inducements. At present the salaries are but a small fraction of what they are in India, though the distance to the Philippines is far greater, and the cost of living much higher. The period of service should be greatly increased and a pension provided for a certain numbers of years' active service in the islands. This would largely increase the force—a thing at present much to be desired—and would give it a more

permanent character. Americans would then be eager to take up a work which for keenness of interest is unsurpassed anywhere in the world.

VI-CONCLUSION

The forest problems in the Philippines are of far more importance than in most countries. On account of the hilly nature of the islands (which are mostly volcanic), the preservation of the forests on the upper slopes is an absolute necessity for the protection of the water supply. And there is also strong evidence to show that forests not only regulate the run-off and retain water in the soil, but actually influence the total quantity of rainfall as well.

In the Philippine Islands, as in no other country in the world, does the solution of the forest problem involve the solution of the land question. Upon the proper handling of this question depends the agricultural development of the country and hence the welfare of a people almost wholly dependent upon

agriculture.

The work being done by the Bureau of Forestry is such that no less a person than Doctor Treub, the most eminent botanist in the tropics, in speaking about forestry in tropical countries, said that the Americans had made more real progress in forestry in the ten years in which they have been in the islands than any other nation in all the time in which they have been in the tropics.

It should, therefore, be the proud duty of every American to give his hearty support to work so well done and upon which in such a vital degree depends the whole future development and prosperity of a people whose best interests his country has pledged its

honor to care for.





FORESTRY WORKERS OF LOUISIANA

Hon. Henry E. Hardtner, Chairman of the Louisiana Conservation Commission, who was recently elected President of the Louisiana Forestry Association. Mr. Hardtner is a practical lumberman, who believes thoroughly in forest conservation and puts his belief into action

THE EFFECT OF THE FOREST UPON WATERS

Translation by MILDRED A. CASTLE, Wisconsin Department of State Forestry, of an Article, La Capacite Retentionelle de la Foret, from the Revue des Eaux et Forets, Paris, January 1 and 15, 1909.

This translation of a temperate summing up of the results of European researches upon the subject of the effect of the forest upon waters is of especial value and interest at this time, when a determined effort is being made by men in high government positions in this rountry to discredit the experience of all nations and the conclusions of the most eminent forestry authorities and engineers upon the subject.—The Editor.

THE aim sought by the numerous associations that are endeavoring to popularize the work of reforestation is not only to ward off a certain deficit in the wood production of our country—a deficit that increases ever with the demands of industry; it is also, and above all, to restore our national commerce and prosperity by rendering stream-flow uniform and by improving navigation in our network of rivers, notably that of our two great rivers in which navigation is becoming more dangerous and difficult every day, the Loire and Garonne.

The remarkable zeal of the promoters of this campaign undertaken to preserve the existing forests and to increase reforestation in the mountainous regions, had its birth in the conviction that the presence of forests causes a more uniform stream flow, lessens the ravages of floods, and sustains springs and streams.

It would seem, indeed, that the action of the forest in regulating stream flow and its favorable influence on floods, as well as on the feeding of springs and rivers, should no longer be in question to-day.

The discussion of this question at the Congress of Navigation at Milan in 1905 showed that there was a divergence of opinion among foresters, hydraulic engineers and geographers. A recent article by the distinguished secretary of the staff of *La Géographie* [Charles Rabot], the review of the

geographical society, presented some points that tended to diminish to a considerable degree the value hitherto attributed to the perennial vegetation of forests in checking floods and regulating stream flow. We beg permission to acquaint the readers of the *Revue des Eaux et Forets* with the ideas advanced on one side and the other of this subject of vital importance, leaving it to them to draw such conclusions as they think right.

I

THE CONGRESS AT MILAN

Papers by Messrs. Wolfschutz, Lauda, Ponti, and Lokhtine

In discussing, in the article referred to above, the papers given at the congress of Milan by Messrs. Keller, privy counsellor of the administration of buildings at Vienna (Austria), Lauda, counsellor superior to the minister of the interior, and director of the central bureau of hydrography of Vienna; Wolfschütz, agricultural counsellor at Brünn (Moravia), and Ponti, engineer in chief of the Italian corps of civil engineers, Charles Rabot expresses himself thus:

"In France, under the influence of the forestry school, every virtue is attributed to forests and every evil is laid to deforestation. For more than fifty years it has been admitted as a scientific dogma that forests, by reason of their capacity to retain rainfall, have the power to diminish great floods in the rivers, and that deforestation is the main cause of inundations; it is likewise to deforestation that progressive diminution in water-levels and in low water-flow is attributed, both so noticeable in recent years. In a word, we look upon the forests as regulators of stream-flow, as immense sponges gathering up the precipitation, however abundant it be, and restoring it afterward gradually.

"According to reports presented by the hydraulic engineers at the tenth meeting of the permanent association of the congress of navigation, held at Milan in 1905, we must discount to a large degree the influence of the forest upon stream-flow and upon springs."

So far as the eminent secretary of the Geographical Society is concerned, the statements made by those who presented the reports establish clearly that the influence of the forest on the runoff from rainfall is nothing in times of flood; that it has nothing to do with the existence of springs, but that it is able to hold the soil on slopes, to diminish the volume of matter carried away by streams, to lessen erosion, and to prevent land slips, except in cases of glacial formations. Mr. Charles Rabot adds that at the congress at Milan the partisans of the forest presented no facts and no observations in support of their theory, limiting themselves to affirmations without furnishing proofs.

The conclusions drawn from the papers referred to above by Mr. Rabot seem to us to be much too arbitrary; the reading of the same documents has not left with us the same impression. We would like to present to our readers at the very beginning the most striking parts of the papers presented at the congress; we will discuss them afterwards.

Mr. Wolfschütz has undertaken to show that the retentional power of the forest fails after an extraordinarily abundant rainfall of long duration. He says in his report: "We must recognize that man is powerless against the principal causes of floods and of abundant rainfall."

According to Mr. Wolfschütz, there fell in the basin of the Rhine 200 millimeters of water in three days, in November, 1882; 215 millimeters in eighteen hours, August 2, 1888, in the Riesenwald; 187 millimeters in twenty-four hours, in July, 1897; 184 millimeters in forty-eight hours in 1897, in the basin of the Traun; 208 millimeters in two days in 1899; 242 millimeters in twentyfour hours at Riechenhall and at Alt-Ausse, September 12, 1899. In 1882, at the time of the Rhine floods, according to Honsell, it was the most heavily wooded watersheds (the Black Forest, the Hardt, the Spessart, the Fichtelgebirge, and the Odenwald) that contributed most to swelling the waters of the Rhine. According to statements of the central bureau of hydrography, Vienna, the most heavily wooded watersheds have often experienced the most disastrous floods, and it was thus in 1807 on the watersheds of the tributaries of the Elbe, in 1897, and in 1899, on the watersheds of the Enns, of the Traun, and of the Ybbs. Even the very dense covering of the Riesenwald had no influence on the floods in the streams of Silesia that occurred, following torrential rains, in August, 1888; July. 1897, and July, 1903.

The powerlessness of man in the case of such an unusually heavy rainfall is apparent to all, but if he is entirely unable to prevent its occurrence, he can, at least, lessen its disastrous effects. Mr. Wolfschütz recognizes, moreover, that the reforestation of some square kilometers "exerts a protective influence on the stream-flow of certain areas adjoining the forests in question or on cleared lands," but that this local and restricted influence cannot extend far.

The report of Mr. Lauda, director of the central bureau of hydrography, Vienna, is one of the most remarkable of those that were presented at the congress of Milan. He takes pains to tell

us in the beginning that "the study of water supply is one of the most difficult problems of hydrography." To solve the problem, Mr. Lauda made minute and very accurate observations in 1903 and 1904, on the amount of rainfall and run-off in the basins of two rivers of Moravia, the Bistritzka and the Seniza. The distance between these two basins is about twenty kilometers. They are similar in the character of the soil, in topography, and in the relative proportion of different kinds of vegetation. Their areas are, respectively, 6,380 and 7.400 square kilometers, but forests cover forty-eight per cent of the territory in the basin of the Bistritzka, while they cover only twenty-seven per cent in that of the Seniza.

The conclusions drawn from these observations are not at all unfavorable to the forest. They are as follows:

The retention of rainfall is in a certain measure greater in the more heavily wooded basin than in the less heavily wooded one.

For abnormally heavy precipitation—as for example, at the time of flood—the retention is less in the more heavily wooded basin than in the one less rich in forested area that is to say that in the latter case, after reaching a certain degree of saturation, the surplus of water that was formerly retained by the forest flows off more perceptibly.

After a dry period the effect of rainfall is manifested more rapidly and more progressively in the less forested areas, while the inverse is true in the basin with the

greater forest area.

Mr. Lauda does not deny, then, the retentional capacity of the forest; on the contrary, he distinctly recognizes it, except in the case of extremely abundant rainfall, when the roles seem reversed and the forest soil, saturated with water, no longer retains the rain that falls, but even allows the escape in part of water that it had retained before.

Mr. Lauda stated that on the 10th of September, 1904, after a dry period of more than three months, a very heavy rainfall occurred of about the same depth in the two basins, but the rise of the waters did not become apparent in the basin of the Bistritzka, which is more heavily wooded, until two days after the flood occurred in the

basin of the Seniza, which is less heavily forested. Similar observations were made in 1904.

The retentional capacity of the forest after a dry period is then well established, and if it is not effective under all circumstances, it proves that the influence of the forest has a limit, which

is not to be wondered at.

We might examine the figures given by Mr. Lauda; but even with the probability that the volume of water constituting the run-off from each river could have been calculated exactly, although errors might easily be made in the case of high floods, it is difficult to admit that the amount of rainfall could have been gauged with sufficient accuracy. A number of rain gauges scattered over an area of 6,000 to 7,400 square kilometers is not sufficient to establish mathematically the exact depth of rainfall. Moreover, is Mr. Lauda right in saying: "Final judgment cannot be passed yet, however, upon the influence of forests on stream-flow, as the data that has been gathered up to the present covers only a relatively short period of time?" We must wait, then, before declaring the theories accepted up to now in regard to the influence of forests on floods, barred by limitation and before treating the action of the forest as merely claimed, not established.

If Messrs. Wolfschütz and Lauda have appeared to some to oppose in their papers the ideas accepted up to now in regard to the action of forests in lessening floods and feeding springs, it is by no means the same with Messrs. Ponti and Lokhtine, whose papers are veritable pleas in favor of the forest. In reading them, one is convinced that at the congress at Milan the "partisans of the forest" have indeed furnished some facts and interesting observations to support their claims.

Mr. Ponti gave in his paper a striking picture of the condition to which Sardinia was reduced after the clearings made on the island in 1870, which lowered the percentage of forested area from forty-three per cent to twenty-six

per cent; floods in the rivers became more rapid, channels were filled with debris, and bridges were carried away. In Sicily, deforestation has likewise had the effect of raising the level of the river beds; in the province of Campobasso (Molise) cuttings made over onethird of the land surface deepened the beds of the streams greatly, and caused the breaking down of the river banks to such an extent that one-tenth of the ground was carried away. Reforestation has produced opposite effects in the province of Grosseto (Tuscany), Avellino (Campania), and Sondrio (Lombardy). In Sondrio reforestation diminished the floods. Mr. Ponti also cites the floods of the Adda in 1806 and 1817, and of the Malero, 1834, which followed very closely upon deforesta-

We will discuss at greater length Mr. Lokhtine's paper, which treats above all of the action of forest vegetation on the flow of springs and streams. This savant cites numerous examples of streams that have dried up and disappeared following deforestation. It is in this way, he says, that the springs around Rome, Vienna, and Constantinople disappeared after cuttings had been made on the hills that surround these cities.

A Roman aqueduct brought to Orleans water from hot springs. There is not a trace left of these springs to-day. Becquerel reported the case of a stream of Caunau, in the commune of Labruguière (Tarn), which in former times furnished power for several fulling mills; after the deforestation of the slopes of the Black Mountain, this stream was subject to sudden floods and its flow diminished to such a degree that work could no longer be carried on. After the denuded areas had been reforested, the flow increased and became more regular; the mills were reopened and could be operated uninterruptedly.

The hills that surround Heilbronn (Würtemberg) are covered with a forest growth, which is subject to regular cuttings made every twenty years. It

has been declared that the flow from the springs diminished when the soil was denuded following a cutting, and that it increased when the forest growth had gained possession of the ground again.

Marchal cites similar cases in Switzerland. The Swiss engineer, R. Lauterburg, states that, for an equal area, springs issuing from forested watersheds have a flow five to ten times greater than those from denuded watersheds. According to the same author, the destruction of the forests that took place in the canton of Tessin during the first half of the nineteenth century reduced by more than one-quarter the flow of the Adige during low-water periods.

Messrs. Shriner and Copeland, who mapped four townships around Monroe (state of Wisconsin, United States) in 1904, observed that the percentage of forested area in this region had been reduced in a period of seventy years from eighty-three to six per cent. The water level of the rivers had lowered steadily; the consequences of deforestation had become more apparent than ever since 1887. More than forty kilometers of streams are dry during the entire year; numerous mills have ceased to operate.

In Kazan, on the tributaries of the Sviyaga River, there were formerly seventy mills which operated steadily. Scarcely thirty are left, which are idle during the summer for lack of water, and are operated with one-third as many millstones as formerly.

The influence of forest vegetation on the flow of springs and uniformity of stream-flow is manifested very clearly, says Mr. Toursky, in the upper basin of the Dnieper, where all the streams and small rivers issue from forested territory and have a regular and constant flow. In central Russia, on the contrary, deforestation has dried up the streams; in the grounds surrounding ancient manorial houses, fish-ponds have dried up and there is no water in the parks, where streams formerly flowed under ornamental bridges of bizarre forms.

According to Mr. Zbrojek, an expedition organized in 1804 by the minister of agriculture of Russia, and led by Lieutenant-general Tillo, found that the upper course of the Dnieper, in a heavily wooded region, holds thirty-four per cent of water per square verst; the Molenka and Nemochtchnaïa, the basins of which are less heavily wooded, retain twenty-eight to thirty-one per cent, while the Liodivitch River, the basin of which is entirely denuded, holds only thirteen per cent. In the basin of the Oka, the same commission found that the percentage of water held rises to thirty-nine per cent in the drainage basin of the Libotije River, which is pretty well covered with forests, while it is only twenty-nine per cent in that of the Traun, which is deforested.

In Russia, as in France, there are numerous historic evidences of the diminution of stream-flow. Streams have dried up in places where the remains of boats and other instruments of navigation are found and where the existence of navigation in former times is confirmed by old documents.

The lowering of the average stream level of the Scura at Pranzine from 1888 to 1900 followed upon extensive clearings on its watershed. A lowering has likewise been observed in the average stream level of the Bielaja at Oufa from 1887 to 1900, following upon clearings made on its upper watershed; on the contrary, the level remained the same at Grouzdevka on the lower watershed of the Bielaja, where the forests were preserved. The average stream level in summer of the Volga was lowered at Rybinsk, at Kostroma, and at Nijni-Novgorod, following the deforestation of that part of the watershed. The diagrams that accompany Mr. Lokhtine's report show this phenomena in a striking way.

These are the most salient facts and the most interesting observations pointed out by Mr. Lokhtine. It is very much to be regretted that Mr. Rabot has passed them over in silence and has not reviewed them with his well-known ability; it would have been very profitable to us.

The following conclusions are reached in Mr. Lokhtine's report: "Forests are a beneficial factor, acting favorably upon an abundance of water in a country, in general, and in particular upon maintaining an even stream-flow. It is for this reason that the destruction of forests should be considered dangerous."

These conclusions should be compared, moreover, with those at the close of Mr. Lauda's report, reproduced elsewhere by Mr. Rabot in the article cited above.

"The utility of the forest in general, as well as its great value in protecting the soil against landslides, appear the more vindicated, because, at the same time, it retains loosened soil, and its advantages from the point of view of the diminution of waste matter carried by the streams, especially on the watersheds of the sources, are so important that this reason alone should be a sufficient motive for undertaking reforestation as actively as possible."

II

We have tried to give in the first part of this study as complete and faithful an analysis as possible of the principal reports presented at the congress at Milan. We now wish to try to show that beside the facts and observations brought to the congress by Messrs. Ponti and Lokhtine, to cite only those two, there are others on which we are able to support a scientific conviction that the forest has a favorable action upon floods, and the maintenance of springs and stream-flow.

THE FOREST AND FLOODS

The principal factors that work together to produce floods are exceptionally heavy rainfall, the geological formation of the soil, and the topography of the land through which the streams flow. A very heavy rain falling for several days on very steep slopes composed of impermeable soil, such as those of the southern slopes of the Cevennes, ends to a certainty in dangerous floods,

like those that devastated Languedoc in the autumn of 1907 and very recently. Man is necessarily helpless in the face of meteorological phenomena, but he can lessen their consequences by protecting the soil against erosion, and by diminishing the proportion of detritus carried by the run-off. It is not necessary for us to offer proof upon this point, the truth of which is definitely admitted by Messrs. Lauda and Charles Rabot.

Since everyone is willing to recognize the efficacy of the "geological" role of the forest (to make use of the term employed by Mr. Rabot), it is a point calculated to make one concede also its action upon floods. The fact that the volume of detritic matter carried by the streams in periods of flood is notably diminished by the presence of the forest must have as a corollary a decrease in the violence of the floods, since it is recognized that the presence of the foreign matter borne along in the current greatly roughens the action of the water. In fact, this detritic mattersand, gravel, pebbles, and rocks-torn from the soil by the stream, raises the level of the stream beds, increases to a large degree the density of the waters. and, as a consequence, their power of undermining, and aids in the erosion of the steep banks.

There is no lack of facts to establish this moderating action of the forest. Mr. Marchand gives an example of a torrent at Weissenbach, in the canton of Appenzell, Switzerland, which formerly became swollen at Weissenbach about three hours after the storms had burst upon the mountain; following a partial deforestation of the mountain, the floods became manifest at Weissenbach only one hour after the appearance of storms. The presence of the forest, then, had the effect of delaying by two hours the manifestation of flood, and of increasing by four hours the duration of the run-off.

Mr. Marchand has noticed a fact of a nature to prove that there is a diminution in detritus carried by the water because of the forest growth. In the great forest of Ofen, canton of Grisons, he saw numerous mud-burdened channels deposit the sediment with which they were charged among the fir trees, and yield only pure, clear water where they issued from the forest.

The diminution of run-off resulting from the presence of forests must be attributed on the one hand to the retention by the forest foliage of a part of the rainfall, a fact verified by the experiments of Marshal Vaillant in 1866 in the forest of Fontainebleau. by those of Mr. Fautrat in the forests of Halatte, and of Ermenonville (1874-1877), and by those of Mr. Mathieu in the forest of Haye; on the other hand, to the innumerable obstacles, the boles of the trees and shrubs, the twigs, the dead leaves, and the inextricable network of roots, all of which break up the rainfall and delay the off-flow. But it is above all to the great absorptive power of the layer of dead leaves, of plant debris and humus, which covers the surface of the forest soil; of moss, herbs, and bushy plants, which grow under the leafy arches of the trees, which, altogether, form what we call the forest floor, that we must attribute the retention of the greater part of the rainfall and of the water formed by the melting of snow. This water, held at the surface, penetrates the soil slowly and unites with the subterranean waters which give birth to springs. A great part is absorbed, besides, by the roots of the plants in the ascensional movement of the sap, and forms a part of their nourishment.

THE RETENTION OF WATER BY THE FOREST FLOOR

The retentional capacity of the forest floor has been established by experiments made in Germany and in France, with great scientific accuracy, the results of which we will state briefly.

Gerwig admits that, upon a surface of one square meter, moss retains on an average 4,466 kilograms of water. Consequently, it is able to retain ten to thirty millimeters of water.

Investigations undertaken by Bavarian foresters upon the volume of water that dead leaves and other organic debris of the forest floor can absorb have been recorded by Ebermayer. These investigations have shown that one cubic meter of dry beech leaves absorbs two to two and a half times its weight of water, one cubic meter of dry needles of spruce and sylvester pine one and a half to two times its weight of water, and one cubic meter of moss two and a half to three times its weight of water.

The Bavarian foresters might be criticized for having experimented on leaves that were more or less stirred up, not lying as they do on the ground, the experiments having been made upon a certain volume of leaves dried in the air, heaped in a vessel, then placed in a sack, which was plunged into water and weighed after two days' saturation.

The lamented Julien Calas, chief guard of the forests at Prades, made experiments on the forest floor exactly as it lies on the ground. It was weighed the first time after complete saturation and the second time after becoming entirely dry through evaporation in the open air. According to Mr. Calas, oak leaves absorb nine times their weight of water, those of the beech and pine eight and five times their weight of water.

Finally Mr. Henry, professor in the national school of waters and forests, likewise experimented with the forest floor just as it lies on the soil. After a section of it had been plunged into water for several days, until it was completely saturated, he let it drain, weighed it saturated with water, then dried it at 100 degrees and weighed it again. He found that a carpet of spruce needles, taken as they lie and composed of leaves in all degrees of decomposition, absorbs on an average more than four times its weight of water.

Beech leaves, after twelve days of saturation, absorb 4.41 times their weight of water. Mr. Henry concludes from his experiments that the spruce needles which cover the forest soil over one hectare can retain 105,825 kilograms of water; that is, a rainfall of ten and one-half millimeters for an average depth of .02 of a meter. As clumps of spruce retain in their tops and allow to evaporate there about half the rainfall, it would require a fall of 21 millimeters for the soil under the needles to begin to become moist.

It is evident that the retentional capacity of the soil cover is not infinite and that it fails following rains that are exceptionally heavy, such as those cited by Mr. Wolfschütz; but such rainfalls are fortunately rare, and neither the facts noted by Mr. Wolfschütz nor the hydrological observations of Mr. Lauda lessen the value of the experiments that we have just reviewed; finally, as the latter said, the data that we have gathered up to the present time is not sufficient basis for a final

judgment.

We may wonder, it is true, that densely wooded river basins have been visited by disastrous floods. But is not the cause of this phenomena the more abundant rainfall there? We know absolutely that the presence of forests increases to a marked degree atmospheric precipitation. In mountainous countries, especially, forests cause frequent atmospheric depression because they block the passage of air currents and force them upward toward the higher strata of air, which are colder. The air within and above the forest is, moreover, colder and more humid than the surrounding air. The result is frequent condensation of the clouds into rains in the neighborhood of mountain forests. Consequently, it is not to be wondered at that the streams of the forested regions cited by Mr. Wolf-

¹E. Henry, Faculté d'imbibition de la couverture morte, Revue des Eaux et Forets, June 15, 1904, pp. 353 to 361. According to M. Henry, the differences that appear between the results of his experiments and those obtained by the German foresters come from the differences in the degree of decomposition of the leaves. The further advanced the decomposition of the organic debris that constitutes the forest floor, the greater is the capacity of imbibition.

schütz have carried more water than the streams of the plain. But what it is necessary to know is whether, all other conditions being equal, and the quantity of the rainfall being the same, the rivers issuing from the wooded regions have a greater or less flow than those whose watersheds have been deforested.

Without going to Germany for examples, do we not know that the streams that descend from the departments of the Vosges mountains, upon which a good proportion of forest area has been preserved, do not have as frequent nor as disastrous floods as the torrents that plow the slopes of the denuded Alps, or the streams of irregular flow that issue from the deforested Cevennes (Ardeche, Lot, Tarn, Dourbie, Loire, Allier) or from the waste lands of the Central Plateau (Cher, Sioule, Creuse). The proportion of forest area of the Vosges is thirty-five per cent, while that of the Alps of Savoy is twenty-one per cent, that of the Alps of Dauphiny (Isere, Drôme, and Hautes-Alpes) thirteen per cent, that of the Alps of Provence (the Lower Alps and Maritime Alps) is twelve per cent, that of the Central Plateau and of the Cevennes, twelve and one-fifth per cent.

The meteorological bulletin of the department of Aude has given us some facts of value upon the effects of a storm that occurred September 12, 1803, which was the most violent of the year and caused considerable damage throughout the whole region. All the tributaries of the Aude experienced sudden floods, and that river rose five meters at Saint Marcel. But what occurred in the basin of the Salz is more worthy of attention. The storm lasted an hour and a half and there was a rainfall of sixty millimeters. Blanque River, which unites with the Salz nine kilometers above Couiza, and which, like it, flows down slopes almost entirely denuded, immediately rose one meter and devastated a large amount of property along the river, especially at Rennes-les-Bains; at Couiza the flood was greater and the frightened inhabitants feared a repetition of the disasters of 1891. In the basin of the Rialsesse, which flows into the Salz six kilometers above Couiza, the amount of the rainfall was sixty millimeters, also. However, this river did not overflow, nor cause any damage. It must be noted that if the Salz and the Blanque are fed by streams that flow down denuded slopes, the basin of the Rialsesse, on the contrary, is heavily wooded and 1,680 hectares have been reforested. It would be difficult to find a more striking example of the influence of forest cover on floods.

THE INFLUENCE OF FOREST GROWTH ON SPRINGS

Mr. Charles Rabot makes use of the assertions of Messrs. Lauda and Wolfschütz to deny absolutely the favorable influence of forests upon the feeding of springs and the regulation of streamflow.

However, the relation that exists between deforestation and the disappearance of springs is established beyond a doubt. The springs of Bresle dried up about 1840, after clearing off a forest of some importance, situated in the parish of Formerie (Oise). The source of the Arrivaux River descended toward Breuil (Somme) one kilometer soon after the forest of Cressy was cut in 1837. The clearings made in the forest of Arronaise were injurious to all the streams that flowed from it to Escaut and Somme

Mr. E. Charlemagne has given an instance to the point in the Revue des Eaux et Forets of the disastrous effects that the heedless cutting of forests may have upon stream-flow. After the death Don Bouthillier de Rancé, the abbé of la Trappe leased the iron works connected with the monastery to private parties for twelve years. It was necessary, according to the biography of Don Pierre the Dwarf, sub-prior of the monastery, "to destroy the forests of la Trappe in order to maintain the furnace fires, and it is impossible to tell how far-reaching the effects were. The springs soon dried up and the ponds

yielded water only six weeks in the whole year." This was written in 1715.

Near the little village of Orgelet (Jura) at the foot of the east slope of the Orgier Mountain, in the parish of Plaisia, there is a spring called the fountain of Plaisia, which disappeared during the entire time that the mountain remained cleared of its forests (from the end of the eighteenth century to the middle of the nineteenth) and reappeared thirty years ago when the work of reforesting the slope had been finished. Numerous inhabitants of the country testify to this fact.

Mr. Alphonse Mathey has noted an interesting fact in an article entitled "The influence of the forest on the flow and the regularity of springs." cording to the testimony of the mayor of Flacey (Côte d'Or), the spring supplying his village had always had a constant and regular flow as long as the limestone uplands from the foot of which it issued, remained covered with a coppice of vigorous oak over an area of 100 hectares. At the beginning of the nineteenth century, this area having been deforested, the spring no longer had a regular flow and entirely ceased to flow the greater part of the

The same author recounts observations made by Mr. de Rothenbach, director of the water service of the city of Berne, on the flow of the springs of that city. The flow per minute of two of them, the Schliern and the Gasel, varied from one to two and seven-tenths and from one to four and one-tenth. while the variation of a third spring, that of Scherli, is represented by the numbers one and six and seven-tenths. Now, the basin of the springs of Gasel and Schliern is sheltered by a considerable mass of forests, while that of Scherli comes from a mountain partly deforested. These investigations clearly prove that the presence of the forest tends to give the springs a regular and constant flow. Other observations also prove that the forest, during dry times, gives out slowly the water that it has stored up during a rainy period. Thus during the summer of 1893, which was marked by a long and destructive dry period, the spring of Scherli reached its smallest flow September 3, 1893; that of Gasel did not reach its low-water mark until three months and a half later; that of Schliern six months and a half later.

In Algeria, "the trees disappeared and the springs dried up," said Doctor Courchon; "in the canton of Bouffarik. formerly noted for its rich water supply, fifteen springs decreased in two years from 1,316 to 710 liters; rivers such as the Oued Chemla, which had a flow in 1864 of 150 to 180 liters, no longer yield more than from seventy to eighty liters; the Oued Kremis, which had a flow in 1864 of from 100 to 200 liters, in 1881 had a flow of only fifteen liters. The water supply of cities like Saint-Denis-du-Sig disappeared and water was shipped in over the railways. The water in the canals of the city of Algiers diminished from year to year. At the gates of the city a striking example of the dearth of water can be observed: Thirty years ago the Oued M'Kacel in its cool valley had the power to turn four mills; to-day water and mills have disappeared with the forest that covered Mount Bouzaréa."

The eminent geographer Onésime Reclus cited the example of the city of Tunis, which was formerly supplied with pure water from the springs issuing from Mount Zaghouan, springs that have disappeared since the mountain was deforested.

The flow of the streams diminished notably at Martinique after the island was deforested, a result of extensive cuttings to make charcoal. In the same way the canal, made in 1867 by Admiral de Gueydon to convey good water to Fort-de-France, diminished considerably, and the government of the colony has very recently adopted measures to check the deforestation.

Mr. Crahay, inspector of waters and forests at Brussels, noticed at Planchimont that the flow from the springs of La Sure became more regular after the

region had been reforested with spruce for forty years. "One of them," he wrote, "that gave no water during the summer, never dries up now, and issues seventy meters higher on the slope than did the former spring. At Bois-le-François, parish of Villers-devant-Orval, after clearing away an old coppice forest, two springs disappeared. The place where the water issued can be seen yet, and the little channel that it followed down the slope."

At the International Congress of Silviculture, which was held at Paris on the occasion of the exposition of 1900, Mr. Grebe, forester councilor at Eisenach (Alsace), cited numerous examples of springs that had dried away or of diminutions in stream-flow noticed after deforestation in central Germany; he told, also, of cases where springs reappeared after reforestation had taken place. Another German forester, M. B. A. Bargmann, told of the disappearance of two springs in the valley on Saint Amarin (Alsace), after clearings had been made above them.

At the same congress, Mr. Servier, a landholder at Lamure-sur-Azergues (Rhône) gave several interesting facts. The region in which he lives having been until late years almost completely deforested, he noticed that wherever a cluster of trees remained, their presence was coincident with the existence of a spring. On the western outskirts of a coppice wood a spring exists; the flow of this spring diminished continually when the coppice had been cut; it became normal when the coppice had shot up again.

Observations made at the German forestry stations show that of 100 millimeters of rain water falling upon forested territory, ten and one-half millimeters evaporate; twenty are arrested by the crowns of the trees, twenty-five are retained by the forest floor. Forty-four and one-half, then, reach the upper layers of the soil. On open ground, evaporation consumes sixty-eight and three-tenths millimeters. Only thirty-one and seven-tenths millimeters, then, penetrate the soil. If the quantity of

rain was the same in the forest and outside, the presence of the forest would augment, then, by twelve and one-half per cent, or about one-eighth, the proportion of water absorbed by the ground.

Without doubt, it is very difficult to prove incontestably the influence of forestation or deforestation upon a particular spring, as it is impossible to exactly determine the area that feeds the spring. Nevertheless, the observations that have just been cited, and to which many others could be added, justify us in arriving at conclusions favorable to forest influence.

The facts verified by Mr. Fautrat in the forest of Halatte (Oise), by Messrs. Mathieu, Bartet, and de Drouin de Bouville in the forest of Haye (Meurtheet-Moselle), from 1867 to 1808, establish beyond a doubt that more rain falls over forest areas than over open country (twenty-three per cent, on an average); this increase of rainfall is not, moreover, counterbalanced by the retention of a part by the foliage of the The diminution of evaporation and of surface off-flow resulting from the presence of the forest contribute equally to favor the nourishment of subterranean sheets of water, which give birth to springs. We can say, then, with Mr. Hüffel that "the forest is the mother of rivers, as our fathers declared," and that "the work of modern science has only confirmed the relationship, recognized at all times and universally, which binds the spring to the tree that shades it.'

Mr. Hüffel has, moreover, described in his *Economic Forestière* the experiments carried on since 1900 in the valley of the Emmenthal, by the Swiss central station of forestry research, in order to compare the flow of two water courses, one issuing from a basin containing only eighteen per cent of forest area, the other from a basin covered with forest over ninety-one per cent of its area. The learned professor has just announced that the verifications made up to the present have estab-

lished:

First, that at the time of the maximum of high water, the channel of the deforested region carries thirty to fifty per cent more water per unit of surface than the wooded region.

Second, that after prolonged dry periods, the springs of the deforested region dry up completely and the bed of the stream is dry, while the stream from the wooded valley is still yielding at least five liters of water per second.

Is it necessary to call attention to the fact that the observations of the Swiss foresters are in complete contradiction to the measurements of Mr. Lauda in Moravia, measurements given, moreover, with express reservations which we have cited above and that weaken very much the conclusions that some have wished to draw from them, hostile to the influence of the forest upon streams and springs?

FORESTS AND THE REGULATION OF STREAM-FLOW

"Forests," says an eminent geographer, "play an important role in the regulation of rivers. They retain for some time the rainfall and lessen the volume of flood flow. Wherever forests have been destroyed, stream-flow has always become more irregular and floods have increased in number and violence."

The clearings made throughout the basin of the Mediterranean caused a diminution in the flow of the streams. Crete no longer has the superb forests of Mount Ida, in which the infant Jupiter was concealed, guarded by the naiad Amalthaea. It has only floods now. One would search Greece in vain for the cool shadows of Algidus, the black forests of Erymanthus, of Taygetus, and of verdant Cragus or the famous forests of Dodona from whence Oropus was born, sad Acheron and Thyamis. All these rivers with the poetical and pleasing names, of which the an-

cients have left us faithful descriptions, became unimportant streams after the mountains from which they issued had been stripped of the forests that covered them.

The rivers of Asia Minor, issuing from deforested uplands, have likewise changed in stream-flow; they are burdened with an enormous amount of detritus, and their beds are incumbered with deposits of sand and gravel which are an obstacle to navigation; several rivers have disappeared completely. Numerous streams in Asia Minor which were still navigable in ancient times and in the middle ages became inaccessible to boats after the region had been deforested. This was the case with the Cestros (Ak-su), with the Calycadnus (Ermenek), with the Sangarius (Sakaria), and with several streams flowing into the Black Sea described as navigable by Arrian.

In the northern part of Korea, where the forests are still intact, the variations in the level of the water courses are insignificant, while in the southern part, where the forests have been almost entirely destroyed, floods develop rapidly and unexpectedly. Vicomte de Vaulserre, who explored in 1898 the course of the Yang-tse-Kiang River from Su-chow to Ta-li-fu. attributes the enormous variations in its flow and the flow of its tributaries to the absence of forests on the mountain slopes of Thibet, which constitute the upper basin

of this river.

The Russian rivers are valuable means of communication in a country almost destitute of railways. For a long time they were the only means of communication, by boat in the summer and by sleds in the winter. These "are the allies of the Russians against that which they call their great enemy, distance," and they have contributed not a little to the conquest and unification of the empire. "Unfortunately," says again Mr. Caména d'Almeida,

^aP. Caména d'Almeida, la Ture, l'Amérique, l'Australasie, Paris, 1904, Colin, p. 103-

⁸J. Deniker, la Géographie, V, 1 er, 1902. ⁹La Géographie, I, 1 er, 1900, p. 451.

⁵A.-P. Rambaud, Histoire de la Russia, Paris, Hachette, p. 8.

"people have not been wise enough to preserve these rivers throughout the country in their primitive condition. The extensive cuttings made in the forest regions of the central part have brought on disastrous results, a diminution in the rainfall, too rapid melting of the snow, the carrying away of the agricultural soil, a greater diffusion of the sands of the southeast, which form bars in the rivers, in the Volga especially, detrimental to navigation." summer the bed of the Volga is incumbered with sandy shoals; sandbanks are heaped up at the confluences and navigation is impossible from Tver to Rybinsk except through a beacon-lighted "These inconveniences have channel. been increased by the heavy cutting of the great forest region that the Volga traverses." The width of the Don is thirty kilometers; but during the lowwater period, the bed of the river is obstructed with sandbanks, which make navigation impossible.

According to a Russian engineer, Mr. Maksimovitch, the Dnieper River is fed by the marshy forest regions of the central plateau of Russia, in which its upper tributaries have their source. In the forest zone which extends southwest as far as the outskirts of Kief, thirty to forty per cent of the land is forested and the rainfall reaches 400 millimeters; in the region where forests occupy only from twenty to thirty per cent of the territory, condensation is less frequent and the rainfall does not go beyond 300 millimeters; in the neighboring regions of the steppes where the percentage of forest area is only one or two, although the sky is frequently overcast with clouds, they but rarely condense, as a natural consequence of the warmth of the denuded soil and the absorption of the water vapor by the equally warm atmosphere, and the rainfall reaches no greater a depth than 200 millimeters.

In Australia forests cover only five and six-tenths per cent of the territory; they are found only on the western coast, in the southeast part of southern Australia and to the east upon the high plateaus and the slopes of the dividing range. Rains are rare and the precipitation small, except upon the eastern coast and to the southwest of Westralia; the basin of the Murray is almost entirely barren and dry. Sometimes a whole year passes without a single drop of water falling in the central region west of Spencer Gulf. The stream-flow shows extreme variations everywhere in the Australian continent and the rivers are generally unfit for

navigation. In spite of the immense extent of its basin, which is more than a million square kilometers and equals that of the Ganges, the Murray River, longer than the Rhine, discharges hardly 350 cubic meters per second at its mouth, which is less than the Seine discharges at Paris. The discharge of the Murrumbidgee, the length of which is 2,160 kilometers, is also one of the most irregular; it often inundates the lower parts of the district of Riverina, but at certain seasons its bed is nearly dry as far as Hay. At the time of rains the Darling has formidable floods; it rises thirteen meters and its bed is extended for a length of ninety-six kilometers; its volume during some days is from 40,000 to 45,000 cubic meters per second, four times more water than the Loire carries in flood. The rest of the year this river, which is 3,124 kilometers in length (nearly the length of the Indus or the Volga), shows, between its deep embankments, only putrid, motionless pools; it ceased to flow during eleven months, from February, 1902, to January, 1903; from 1877 to 1886, ten years, there were only fiftyseven months that it could be used for navigation. In 1902 the Lachlan, another tributary of the Murray, 1.120 kilometers in length, was dry for nine months.

The Australian rivers have great erosive power and flow between steep banks, which often have a height of fifteen or twenty meters. Along the lower course of the Murray, the river flows between two escarpments from forty to forty-seven meters in height; the naked roots of the gum-trees hang sadly from the top of the compact clay banks.

The Ohio River, which descends from the now denuded slopes of the Alleghany Mountains, "is the cause of the largest and most disastrous floods in the Mississippi." The streams swell very rapidly in the southern and western part of the Alleghanies, and it is not unusual for a river to rise twenty

meters in a few hours.

On the banks of the Kansas River, a tributary of the Missouri, one can observe the remarkable effect that forest vegetation has in protecting the soil against erosion by floods. A stretch of about two hectares, which had been deforested in 1900 was carried away in May, 1903, by a flood. The steep bank of the river, being no longer protected by the trees that had grown along the edge, was swept away and the flood covered twenty-four hectares of arable land with sterile sand. Above this point, where the owners on the river had taken care to preserve the trees along the edge of the bank, the flood caused no erosion.

It has been verified in the United States that the flow of the rivers and streams has decreased in all deforested regions. Certain streams near Boston, the power of which was formerly utilized in manufacturing enterprises, no longer have sufficient flow and the manufacturers have been obliged to use steam. The tributaries of the Connecticut have diminished considerably in volume and the beds of some are dry

during summer.

Mr. T. P. Lukens reports in the magazine Forestry and Irrigation a striking example of the influence of forests in regulating stream-flow in southern California. The basin of the San Gabriel River, which includes an area of 222 square miles, having been burned over by fires that destroyed all the forest vegetation, the flow of the

stream at low water was reduced to ninety inches. During the same period the minimum flow of the San Antonio River, the basin of which, 267 square miles in extent, was forested over more than one-half the area, did not fall below ninety inches [190 inches according to Mr. Lukens' account].

In the same journal Mr. W. B. Greeley gives an account of some investigations made by the United States Forest Service from 1901 to 1903 of the flow of the Esopus and of the Wallkill, tributaries of the Hudson River. The drainage basin of the latter stream, of clay and marl formation and with moderate slopes, contains five and fourtenths per cent of natural reservoirs (lakes, swamps, or ponds); eighty-five per cent of the area is cleared. basin of the Esopus is of permeable soil; the topography is very irregular and the slope in general twice as steep as in the basin of the Wallkill. Clearings have been made over only fifteen per cent of the area. The precipitation and temperature being the same in the two basins, it has been found that the average deviation from the mean weekly flow in the two streams, during the three years, was seventy-eight and one-fifth per cent for the Wallkill and eighty-three and seven-tenths per cent for the Esopus. The presence of forest growth in the basin of the latter stream counterbalances the unfavorable conditions of topography, and geologic formation of the soil and the absence of lakes and other natural reservoirs.

A publicist whose economic studies of Germany and the United States have classed him as without an equal, writes in regard to the forests of Canada: "Recent federal laws have just regulated the cutting of timber, which was carried on formerly in too destructive a manner. The people have come to the conclusion rightly that forests were not to be considered only as 'a collection of trees to cut down and make into

'Forestry and Irrigation, Washington, February, 1904.

P. Caména d'Almeida, la Terre, l'Amérique, l'Australie, p. 192.

^{*}J. Lefaivre, attaché au Consulat général de France à New York. Rapport au Ministre, Bull. Min. Agriculture, fasc. B., 1885, imprimerie Nationale.

timber, but that they should be in part preserved, because they store up the rainfall, feed springs, regulate streamflow, and thus prevent disastrous floods, such as were witnessed only last February and March in Pennsylvania and Virginia, where cuttings have been made without thought of the future.""

In France we have numerous proofs of a notable diminution in stream-flow. The Durance, which rises in a partially deforested drainage basin, has become absolutely unfit for navigation or for floating timber. Yet, at the time of the Roman occupation, there was an important organization of boatmen on that

river.

The Loire was formerly a navigable channel of the highest order, which afforded sure communication between Nantes and the central provinces. In 1551 the Marquis of Northampton, ambassador from England, went from Orleans to Nantes, with his suite, in "five large, many-cabined boats." Numerous pictures dating from the eighteenth century represent Orleans and Blois animated with veritable flotillas of boats of every kind.

At the time when Gaston d'Orléans was exiled to Blois by Richelieu (1634-37), he went down the Loire by boat as far as Brittany, having "dinner and soup served in beautiful, shady places" when he found "some beautiful and pleasant isle." At that time these covered boats were called galliots; they carried in them "a large amount of provisions and a retinue of servants, as well for the kitchen as the wardrobe."10

Madame de Sevigné went from Orleans to Rochers by "the delightful route of the River Loire" and found at Orleans twenty boatmen around her, "each one displaying to the best of his ability the rank of the people he was conveying and the beauty of his boat." Steamboats furnished service as far as Nevers during the first half of the nineteenth century.

Upon the Allier, transportation by boats was flourishing. Madame de Montespan, returning in 1676 from the watering place Bourbon-l'Archambault, embarks at Moulins, upon a painted and gilded boat, the interior hung with red damask, and adorned with pennants displaying the arms of France and Navarre. In 1819, the passage of 2,178 boats was recorded at Moulins; this number rose to 3,524 in 1820, and to 4,718 in 1823. In 1837, 100,000 hectoliters of coal were unloaded annually at Pont-du-Château. A line of steamboats carried from Pont-du-Château to Vichy and Moulins in 1845 20,000 passengers and 30,000 to 40,000 tons of merchandise. In 1890 only ninety-four tons of fuel and timber were carried down the Allier; there is no navigation

ascending the river.

At the present time navigation, almost null on the Allier, is impossible on the Loire above Saumur. The bed of the river has risen with frightful rapidity because of the enormous volume of matter torn from the soil of the mountains of the central plateau that it carries with every flood. It has been shown in fact that the remains of Roman villas recently discovered on its shores are several meters lower than the present level of the river. It is the same with the old Roman churches, into which it is necessary to descend as into caves, and yet it is impossible to suppose that their architects built them below the level of the river. The building of dikes, instituted in the seventeenth century along the Loire to protect the cultivated fields of the valley against the overflowing of the river, coincides exactly with the time of the clearings made on the mountains of the central plateau, that Colbert tried in vain to check.

Forests cover hardly thirteen per cent of the area of the drainage basin of the Loire, which is, moreover, composed of impermeable ground.

Jules Huret, En Amérique, de San Francisco au Canad, Paris, 1905, E. Fasquelle, p. 461. Nicolas Goulas, Mémoires.

[&]quot;Mme de Sévigné. Lettres a Mme de Grignan, 9 Mai, 1680; 16 Sept., 1684; 21 Mars, 1689, etc.

mountains of Velay, those of Vivarais, of Forez, and of Margeride, the group of the Dômes and of the Dore Mountains, show denuded slopes in every direction, favorable to a surface off-flow, furrowed by water channels and gullied by erosion; the plateaus of Millevaches and of Gentioux contain only sterile wastes, impotent to arrest

the action of flood waters.

On account of deforestation the Loire, like the Allier, is no longer in summer anything but a great stretch of sand. Let a storm come, a sudden thaw in spring, or prolonged rains in the autumn, "every depression of the ground gathers a torrent, every ravine confines a river, and all these waters, accumulated in the valley of the Loire, form a roaring sea, which reminds one of the great rivers of America."12 Roanne, the flow at low water and the flow at times of flood is in the ratio of one to 1,458. The flow at Orleans oscillates between twenty-four cubic meters per second and 7,500, which is more than 300 times the flow at low water. Five days are sufficient to restore the almost dried-up river and to raise the water level to six or seven

The Pyrenees offer numerous examples of the sad effects of deforestation upon stream-flow. Dralet, in his "Description of the Pyrenees," published in 1813, tells us that the Tet, a small stream of the eastern Pyrenees, could not be used to float rafts and timber after the removal of the forests that covered a part of its upper drainage basin. The Salat and its tributaries, likewise but lately floatable, are only torrents now that the mountains that overlook their valleys have been cleared of forests. In the parish of Saint-Girons one can see yet in a wall built in 1130 chains which were used to hold rafts; in 1813 they were found to be at an elevation of one meter and had become useless, the navy no longer finding wood to cut in the territory around Seix and Castillon. The Salat

was formerly navigable from the port of Saint-Girons to its confluence, and the village of Lacave, sixteen kilometers below Saint-Girons, was at that time the center for the building of boats

for river navigation.

Numerous documents preserved in the municipal archives of Pamiers prove conclusively that in the thirteenth century the Ariege was navigable from Pamiers, while at present it is navigable only for thirty-one kilometers, below Cintegabelle. At that time the city of Pamiers had a great trade in wines. which they shipped by water as far as Bordeaux. In the eighteenth century people still went by boat from Pamiers to Toulouse and vice versa. The Ariège was used also, as was the Hers and the Arize, for floating logs. The flow of all these streams has constantly diminished because of deforestation.

In the eighteenth century logs were floated on the mountain river Aspe, whose union with the torrent of Ossau forms the River of Oloron. From 1705 to 1780, the royal navy cut in the forests of the Valley of Aspe timber for masts, which was floated at Athas in rafts thirty-three meters long and four and six-tenths meters wide and driven to Bayonne. It would be impossible to accomplish this to-day. The mountain river Aspe, as also the Ossau and the Oloron, has become an unruly torrent, and its flow, which varied a hundred years ago from thirty-three one-hundredths of a meter in summer to one meter when the snows melted, varies to-day from ten meters to two and seven-tenths meters. During more than eight months the depth of the water does not go beyond one-half meter. This diminution in the stream-flow and increase in the difference between the high and low water mark, are the result of deforestation. In 1813 there no longer remained of the forest of Issaux, which for fourteen years supplied the navy with trees of the largest size (one and six-tenths meters in diameter at the base), anything but the

¹²F. Schrader et L. Gallauédec, Géographie de la France et de ses Colonies, p. 143.

soil, bare and dried up. The forests were laid waste during the revolutionary period; the devastation of the woods, over pasturing, clearings, and fires have so reduced the forested holdings that stony and denuded slopes appeared in the valley instead of verdant forests of fir and that "immense stretches of greensward, dilapidated, have given place to gray rock, like a mantle worn even to the thread." The forest of Issaux, which extended in 1765 over 3,580 hectares, covers only 1,380 hectares.

The Adour, at the beginning of the eighteenth century, still floated the mountain timber; it is no longer navigable in the province of Hautes-Pyrénées since the destruction of the immense forests of Baudéan and of Bagnères, which covered a part of its drainage basin. "Every autumn now all the mills in the lower valley, being without power, are idle for months."

Finally, the Garonne, frequented before the Roman conquest by the boats of the Gallic tribes which conveyed to the markets on the two shores of the river the pottery made by the inhabitants of Tolosa, later a vast emporium for merchandise, coming from Rome. from Arles and Narbonne to Aquitaine, traveled unceasingly by associations of boatmen (scapharii utricularii), whose privileges were afterwards recognized in the twelfth century by the counts of Toulouse and became in the fifteenth century the source of considerable fortunes for the trading corporations—the Garonne is subject to floods during which its volume increases to 262 times the low-water flow, and threatens the city of Toulouse with its terrible inundations, so severely experienced in Modern geographers do not 1875. hesitate to attribute this sad state of affairs to the deforestation of the Pyrenees.

But the relation that exists between the denudation of the soil and the change in the rate of stream-flow had been noticed for a long time by the

wise observers of this region. In the eighteenth century Froidour pointed out the fact that the forests near the banks of the Garonne had been laid waste and wrote that it was urgent "to take an interest in replanting them." A century later, Dralet uttered a new cry of alarm. "Several rivers formerly navigable or floatable." he wrote, in 1813, "lack water in the summer only to the degree that the mountains in which they rise have been stripped of their pastures and forests." Elsewhere he says: "If tradition and ancient documents are consulted, it will be found that several streams, formerly floatable in the valleys, can no longer be used at all, or at least until after their confluence with other streams in the plains; this misfortune has come in those parts of the chain where the inhabitants have made extensive clearings, while the rivers and streams in the valleys where the forests have been respected have kept their volume of water.'

The belief that the presence of forests exerts a favorable influence in preventing floods and in sustaining springs and streams, is not a new one. as we have stated. Eleven hundred vears before our era Tiglath-pileser, King of Nineveh, undertook the good work of reforestation on the plains of Mesopotamia and upon the barren slopes of Mount Masias. The inscription carved on the rocks of Bavian near the springs of Haser, tells us that Sennacherib also had forests planted. Pliny the Elder, the celebrated naturalist, pointed out in his time floods caused by clearings: "Plerumque vere damnosi torrentes corrivantur detracta collibus silva, continere nimbos ac digerere consueta."

From 1684 the engineer, Viviana, taught, in relation to the floods in the Arno, that the presence of forests supplemented the action of dams in holding back water and preventing erosion.

At the beginning of the nineteenth century, as we have seen, Dralet attributed to deforestation in the Pyr-

¹³Pierre Buffault, Forêts et Gaves du Pays d'Aspe, Bordeaux, 1904, imp. J. Durand. ¹⁴L. A. Fabre, L'Erosion pyrénéenne et les alluvions de la Garonne, Paris, 1902, A. Colin.

enees, the diminution that had become apparent in the flow of the streams that had their sources in these mountains.

In Italy, Perelli, and Paleocapa also, in 1841, admitted that rainfall is partly retained by the forests. Paleocapa affirms also that the increase of floods is the result of denuding the mountains. Lombardini also in 1858 maintains that the forest retains the rainfall and delays the arrival of the afflux in the channel.

"The destruction of forests, the failure of perennial springs, and the existence of torrents," Humboldt wrote, "are three phenomena closely interconnected." "After deforestation," he says, at another time, "water flows unchecked, without having time to infiltrate; it carries away the soil from the slopes, gathers in every depression of the ground, and forms torrents that hollow out channels and force along masses of sand and pebbles, which are left upon the surface of the lower lands or are carried into the rivers that receive the flood waters." Can the ravages made by the torrents from denuded mountains be more clearly described?

In 1707, Fabre, the engineer, in his "Essay on the Theory of Torrents and Streams," had drawn attention to the ravages of torrents and pointed out as the original cause of their formation the destruction of the forests that covered the mountains. The protective action of forest foliage upon the soil, the retention of a part of the rainfall by the humus, the diminution of the volume and swiftness of the waters by the presence of bits of trees and clumps of underbrush were well understood and described by him. Later Mr. Dugied, a former chief magistrate of the Lower Alps, in a memorial addressed to the minister of the interior, attributed the desolation into which the department was plunged to the destruction of the forests and the mania for clearing land.

Moreau de Jonnès, in a memorial crowned by the Royal Academy of Brussels in 1825, maintains that mountain forests feed springs and increase

stream-flow, and he affirms that "their conservation and extension are measures of public economy no less indispensable to modern society than the dredging of streams or the making of canals." This is the opinion of Michel Chevalier, also, in his work on "The Material Interests of France." cording to the eminent economist, the navigability of streams would be greatly improved by "the replanting of the mountains that have been stripped of their woods with such great lack of foresight and have been abandoned in their nakedness with guilty indiffer-

Finally, shall we add that Mr. Alexandre Surell, in his authoritative work on "The Torrents of the Higher Alps," extolled reforestation as the efficacious remedy for the disasters engendered by the incessant development of torrents? He was the great promoter of the work

of reforestation.

There is in France at the present moment a marked reawakening of the forestry idea, which is the result of the influence, already old, of writers like Michelet, economists like Michel Chevalier, and of engineers like Surell and Cézanne. The professional foresters, born but yesterday, count for little in this movement. At its head we find among the geographers: Onésime Rec-Schrader, Caména d'Almeida; lus, physicians, Léon Petit, Trolard; the poet, François Fabié; the artists, Saint-Saëns; among publicists and statesmen: Pierre Baudin; finally, among powerful organizations, full of ardor for the prosperity and upbuilding of the country, composed of engineers, bankers, merchants, and so manufacturers. forth: The Touring Club of France. the Loire Navigable, Southwest Navigable, Association for the Forest Management of the Mountains, Society of Friends of the Trees, Reforestation League, and others. It would be much to be regretted if upon the evidence of experiments, more or less conclusive, made beyond the Rhine, the import of which, moreover, has been singularly

exaggerated—especially when other experiments, quite as important, lead to opposing conclusions; when facts that have been observed and historic proofs abound to attest the influence of forests in regulating stream-flow and sustaining springs; when, moreover, final judgment could not be pronounced on so complex a question at the present stage of our knowledge—if this movement should be checked, if the zeal' displayed by disinterested men should change to sterile skepticism, and if the

efforts put forth to develop national wealth and industry should remain henceforth impotent.

Let us remember that if Germany is endowed with an admirable network of streams of more than 27,000 kilometers, the possession of which contributes not a little to the constant growth of its trade, both domestic and foreign, she owes it largely to the very considerable proportion of forests (twenty-five and eight-tenths per cent) that are included in her territory.

STORIES TOLD IN RANGER CAMPS

By CHARLES HOWARD SHINN, Supervisor of Sierra National Forest

Number 2

AM never surprised at anything that I hear in this vale of tribulation, especially at a ranger camp-fire. One is apt to get new and strange views of many sorts. But I think the history that grows instinctively about a mountain camp-fire is especially worth the attention of the psychologists.

One of the rangers had picked up a week-old country newspaper; it contained a kidnapping story.

"Ought to hang a man that would steal a baby," he said, shoving the paper under the back-log.

"Huh!" said the much-read ranger who loved to tell about things. "That's nothin' to them scalawags that used to live in Egypt. Stole boy babies for a regular game."

I rolled up my memorandums and curled down to listen, wondering

whether this was to be a tale of cruel gypsies or of dreadful man-made Quasi-modos.

"Go ahead, Tom. Trot her out. Tell us about it right now."

"Well, once I had a hist'ry teacher who used to 'liven up the Friday afternoons by givin' us all sorts of interestin' facts—real gospel facts, you know. This particular one was about a tribe of Turks that lived next door to the pyramids. They was big men, all dressed up, and they did professional fightin' for the emperor of Egypt."

("It was ye Soldan of ye Faithful, in the days of ye lovely Princess Sabra," I murmured softly to myself.)

"In this here tribe of fighters, each man wore a horse-tail, an' some of them three horse-tails, an' each man had a camp kettle, an' when it was empty he went an' threw it down at the emperor's door an' made a row till he got some

grub.

"Each man carried two half-moons of swords in a great belt three inches wide, an' he wore carpet slippers with his name worked on in pearls, an' he had four white horses, splendid, welkept up, an' several slaves of both kinds, an' the only work he did was fighting for fun an' carrying off loot, an' ridin' proud in processions."

"That sounds bully," said one ranger,

"who were those ducks?"

"They called themselves Mammy Lukes, the teacher told us. Queer name, but, then, it was because of their main trick of stealin' babies. They used to ride all over for hundreds of miles an' they picked out the strongest an' spunkiest boy babies an' took them into camp an' brought them up to be Lukes, too. That's how the tribe was called Mammy Lukes. Fed 'em, trained 'em, made 'em regular fighters; several thousand baby Lukes all runnin' around an' gettin' prizes for killin' the Emperor's enemies."

"Hm-m. Don't think much of that game, first kidnappers an' then nusses, every one going around with half a dozen stolen kids yellin' at his heels! I always thought Turks had some dignity, and when they weren't fightin', set cross-legged in the shade and smoked an' drank coffee. But your mammy tribe couldn't have done no real fightin' with all those kids part and parcel of the

muss."

"Lot you know! They wasn't fools. Naw, they took nusses an' slaves an' had the young ones brung up from the word go. No trouble. All discipline done on the side. Big Mammy Luke rides down a thousand miles from north end of Asia—has a woman nuss in charge of one of his slaves, packin' a small boy. Takes him to the boss, 'Here's the finest boy in them north tribes; put on the mark an' the number, an' set him practisin' shootin'." Then he goes off; all through with his trouble. Twenty years later, when he is gettin' old, there ranges up a fine

young fightin' Mammy Luke, an' the old coot sees, by the tattoo mark on his arm, that it's the same, growed up, an' they wade in together, swingin' their swords against the enemy."

"Bad lot!" said another ranger.

"Who killed off them fellers?"

"Huh! You evidently don't appreciate them fighters! But if you want to know, after they had been up agin' all kinds of famous generals from Alexder to Napoleon, they come a time when the whole tribe got sassy-don't know why? Then the emperor of that time invited them to a peaceful confab, an' the dam' Mammy Lukes rode careless into a big court-yard, an' the emperor fired his six-shooter an' off comes the cloths from hundreds of loaded cannons on the walls and the emperor had 'em killed, but even then they nearly cut their way out and made a new emperor. That ended the whole tribe for keeps."

Alas! The name Mehemet Ali had been forgotten! But how clearly the wild Mamelukes shone out across the

tale!

"Four white horses, an' plenty of horse feed!" said a ranger. "That part of it struck me. I don't admire white plugs myself, but that's incidental. Four!"

"Yas," said another, "I remember that fellow that peddled soap an' sold minin' stock told a yarn about a place in South America where hosses was even plentier an' better than with them black Egyptians, an' all colors, too. Them Egyptians was all coal black, I suppose, an' they set themselves off with white hosses."

"Let's have that varn."

"Well, the fellow said as how there was once a tribe of people named Aracarians—queer name that. They lived somewhere south of Peru, down towards Patagonia. They hated all the Spaniards. When a young brave wanted to marry, he had to kill three Spaniards first. They had a river. I remember its name cuz it was so queer —Bio-Bio— an' on an island in the middle of that river grew millions of crab-apple trees. The women went

there an' made slathers of hard cider; then the men went and held an election every year—gave their weapons to the women, an' got awful drunk. Sometimes the whole tribe went away with thousands of the splendid horses an' lots more they took from the Spaniards, away back to valleys of the Andes. When a brave rode out, his servants kept bringin' on a string of fresh horses, an' they changed saddles every hour, goin' like the wind, always travelin' to war, or comin' home.

"There never were such men anywhere else, such giants of fellows, fearless, and a terror to their foes. The soap peddler said they had first-class chiefs, an' they built up a kind of republic of their own an' drew a line between their land and that of the Spaniards. But at last, he says, the Spaniards come down very still an' quiet an' with an' army, took the country, built a city they named Valdivia, an' began to mine for gold. Then down from the high mountain valleys rode these horsemen, thousands of 'em, and they tore the settlement all to pieces. Then they took the chief Spaniard an' set him down on a chair, an' promised him plenty of gold, since that was what he seemed to want. Then they melted a heap of gold and poured it, all hot, down his throat—and went back to their Andes."

"That's great!" said one ranger. "How much of that is true?"

"A whole lot of it," I said, coming to the rescue of the story-teller. "The Araucarians of Chili were a wonderful and a heroic race of men before the vices of the whites conquered them. They were the Cossacks of earlier South America as far as horsemanship went, and nobody knows how much trouble they gave the successors of Pizarro. They really 'came into camp' to the Chilians about 1870."

"Guess I'll try to get an exchange into some forest down there in Chili," said one ranger.

"You will have to have a new language and a new religion, and otherwise hit a new gait altogether. Besides, these things happened a long time ago. Caupolion, the chief, who once traveled with his ten wives and his 500 picked horses, and who sat at the head of the tribe when they caroused on the Island of Crab-Apples, was dust, with all his belongings, ages ago; his land is changed into farms and fields, and I guess some of his descendants are plowing there now."

"Seems to me very often when I hear about things," said another ranger, "as if I had come into the world some too late. It would bust me up if I let it strike in deep."

"Onc't I took out a party of nice fellows from Philadelphia," volunteered a third retailer of old stories, "and they had a book they read out loud in camp. It was all about a great, fine, expensive French cardinal named Rishloo. He was mighty good to his friends and mighty stiff with his enemies. there was a green young feller from the country that had a rusty old sword and rode a buttercup-colored horse. fought everybody that poked fun at him. Pretty soon he was chums with the best bunch of fighters in France and up against old Rishloo who bossed France about then."

"What was the king doing?"

"None of them kings counted for anything. But I wish I could run across that book again. I wish some fellow who knew how to read out loud in good shape could read that thing to our camp next winter."

"It's in the ranger library," said another. "It's The Three Musketeers. One of the big guns from Washington wrote his name and gave it to the boys."

"Is the fightin' kid that rode the buttercup-colored horse in it?"

"Sure."

"Well, you show it to me next time we hit headquarters. That's the sort of history I like. None of your old Turk kidnappers, nor your Dago cider drinkers. I don't call that no novel. That book just writes down things exactly as they happened to real live people."

"They happened pretty durn quick

and frequent for history."

"Mebbe, but then the world was younger an' folks was livelier in those days. Seems to me that nobody of any consequence had any work to do; nobody wanted to get rich; soon as you corralled anything, you blew it in."

"I suppose that went on for ages, everybody having a good time, till the land wore out and the timber was cut and the game all gone, and the whole thing badly wrecked and tangled up with thieves and loafers on top. Probably that's why people have to work so hard now, and so many things are all wrong. I must say I don't admire those happy-go-lucky fighters. Somebody always pays for their keep."

This last ranger, who was grizzled and worn with the cares of life, rose and rolled the camp-fire logs together, and sat down in silence. A little of his idea filtered through the minds of the youngest rangers and shone in their eyes. Through some strange process of thought, broken fragments of stories they had gathered up here and there, so full of blunders, so curiously tangled and transformed, had, nevertheless, left in their minds some sense of the realities of life. They could not put it into words, but they saw that always, since the world of men began, some things lasted and others perished.

"I guess," said one, as he began to roll up in his blankets, "that decent fellows have always had to work hard at something. Mostly, too, it's better

fun than the other way."

NIGHT IN THE WINTER WOODS

Rank after rank the patient trees
Rise up against the sky,
Strange voices whisper in the breeze
That sways their heads on high.

Beneath lies silence, robed in white, Broad billows like the sea, Her garments all with gems alight, That gleam mysteriously—

The world of men, and all it holds
Of care, is far aways
Here's naught but peace, the night enfolds
To hide the scars of day.

-J. B. Carrington in Outing

Economic Selection and Processing of Raw Materials in the Paper Industry

By MARTIN L. GRIFFIN, of the Emerson Laboratory, Springfield, Mass.

THE selection of raw materials and the most economic treatment of them, or the determination of the normal product from a given raw material, is a most important question to decide by those already in the business or by others contemplating it. Failure to grasp the significance of this results in economic waste and loss of profits. The artistic and commercial value also of the product will often suffer seriously.

The manufacture of paper naturally lends itself to the tempering of such raw materials as result from other industries. To a considerable degree it is the treatment of by-products. It is, or should be from the very start, a building-up process from the raw material. In a considerable sense, it is a plastic art wherein the composition of the finished product bears little resemblance to the original raw stock.

The textile industry creates value in cotton by the mechanical processes of labor without changing its nature; the paper industry, taking the residue of this and other industries, creates a new value by mechanical and chemical treatment; and, without spinning and weaving, molds a product comparable with the finest fabrics. How great then will be the gain to civilization when the principle involved in this illustration becomes the ruling spirit in paper making!

The manufacture of paper has made enormous strides and has been highly developed during the last few years, but has, unfortunately, lost ground at many points in economic treatment. The extrayagant consumption of paper has brought with it extravagant methods of manufacture,

Sawmills producing lumber for structural and ornamental purposes have given place to pulp mills, a large proportion of which treat the wood chemically, occasioning a shrinkage of over one-half the original solid contents. I except ground wood, of course. This condition has come about through a most natural process. The value of our forests as a source of lumber has been less than as a source of paper stock, while stream conservation and effect on climate, and all that goes with it, have been given little consideration.

Undoubtedly there is already, or can easily be produced, a sufficient quantity of unappropriated material suitable for the bulk of the needs of this industry.

As the value of the forest increases, there will be some lessening of the consumption of wood, and a gradual appropriation of other sources of raw material until it has reached its normal equilibrium. To this end, greater diligence will be exercised by those mills relying upon wood, in adapting their conditions and processes to the most economic results.

Manufacturers who are making a class of papers to which wood is normally adapted, as news and under certain conditions wrapping, will not pass through the ordeal which those will who have misapplied wood to the manufacture of higher grades, but still very inferior for the uses designed. These, in the nature of things, will have to contend with the increasing cost of wood, the growing revulsion of the pub-

lic against paper of such quality, and the competition of new sources of raw material which will satisfy these condi-

tions better.

The art of paper making lies along two lines, including both mechanical and chemical details: raw materials for coarse products and fine products. A coarse raw material may be given a thorough, exhaustive treatment to make the highest grade product possible. In so doing there will be a consequent large shrinkage in yield and economic waste, and at a high cost; or the same material may be given a slight and inexpensive treatment to adapt it to a coarse product, which by nature it is best suited for. The product in this case will not be so high priced, but the cost and shrinkage will be low and the yield correspondingly large. The value of any raw material should not be dissipated through failure to make the most appropriate use of it.

Closely allied to the lack of such discriminating judgment in determining raw materials and products therefrom, is the failure to get the most out of the process. The sulphite process is often misapplied in the making of wrapping paper, and often badly managed in the yield of pulp. For such papers, only a sufficient softening treatment is necessary to make the stock pliable and workable, thus preserving strength and yield. This is practically illustrated in the process of boiling with water and weak chemicals for leather board and

kraft paper.

If the cornstalk should ever come to be used for making a medium grade of white paper, its use for such purpose would be misapplied. Its normal place, if it has any in the paper business, will be found in connection with other suitable material to make boxboard, wherein the bulk of its solid contents could be made available at a slight cost for reduction. Failure to recognize its true place will result as in the past. From a practical as well as an economic standpoint the attempt to make out of paper stock a sanitary milk bottle to be used only once is such a perversion that

nothing serious need be expected from it.

It is often the practise to reduce stock to one level base and build up specialties from this. The skilful paper maker will select his raw materials with a view to close adaptation, avoiding the double cost of reducing to a base and building up from it. It often happens that effects can be gotten in this way that would be impossible in any other. This is shown in the manufacture of many

very attractive cover papers.

Raw materials should be selected and processed with discriminating care and judgment so that there shall be as little degradation from one product to another as possible. In this way economy of production and conservation of resources will be promoted. It is to the credit of the industry that we have in abundance the attractive gray news board, though its coming was purely accidental. If old news could be so treated as to be used over again for the same grade of paper how great would be the economic gain! This is done to some extent in the case of printed book papers.

In the manufacture of heavy papers and particularly boards for a great variety of uses, I do not believe the use of the cylinder machine has been applied to anything like the limit of its possibilities. With properly prepared stock for lining, this machine is capable of using very inferior grades of stock for the middle, and producing a product of great attractiveness and growing usefulness. Such a product has a great market before it in furnishing material for small packages for which wood has been used, but is becoming too costly.

Up to the present time there has been, in the main, only one object in view in treating raw materials, namely, the obtaining of paper stock; and I regret to say this work has been done largely by the use of drastic agents in a single operation. Henceforth more selective processes will be discovered, resulting in economy of chemicals, recovery of useful products and larger yield of paper stock.

In the field of raw materials there is line, on the one side of which paper stock has been largely developed at the expense of all else; on the other side there is now a small area where raw materials are treated for useful products only, but with an ultimate view to the making of paper stock; I refer to the extraction of waste pine wood for

turpentine and rosin and of chestnut wood for tannin. These latter will soon enter the field of paper making.

It is, therefore, of great importance that the whole industry should look into its raw materials and processes to see if there are not still many undiscovered sources of economy and productive wealth.

FEDERAL AID FOR TEACHING FORESTRY

By PROF. SAMUEL B. GREEN, University of Minnesota

T IS the work of the real statesman to concentrate the enthusiasm of the present moment into the actuality of the thing done for the future. The enthusiasm of the moment cannot last. The present enthusiasm for forestry cannot be expected to continue for many years in its present vigorous form. This enthusiasm has been created largely by, and is largely responsible, also, for the creation of the present grand and effective work that is being done by the United States Forest Service. I would not for a moment belittle the value of the United States Forest Service, for, like the accomplished and devoted man at its head, it has for a number of years been a great source of inspiration to all engaged in forestry On the other hand, this federal work must be supplemented by a strong, well-grounded public interest, or it cannot accomplish the greatest good. This must be done in each state. In its last analysis forestry is largely a business, and must stand on a business basis. In comparatively few, if any, of the states has it reached this stage of development. Great reforms are most quickly made permanent and helpful by educating the young. There is no question but that we shall continue to educate lumbermen and others of mature years in forestry matters; but the foundation

of the forest wealth of the future should be found in the establishment of firstclass forest schools, and we need at least one school of this kind in every state and territory in the Union. It is probably best that these schools should be connected with the agricultural colleges, since these institutions are well fitted for taking up a work of this kind. It seems to me that an especially fitting use of public funds is for the promotion of some line of endeavor making for the permanency of the state as a whole. That forestry and the conservation of natural resources represent such a work should be evident.

The request for a congressional appropriation for the teaching of forestry is not a raid upon the public treasury, but is an endeavor to insure the welfare of the future of this country, and is something that should commend itself to every statesman. My idea is that appropriations for an object of this kind should be so made as to encourage the states to do something for themselves. On this account, H. R. 9219, a bill now before Congress and known as the Davis Forestry Bill, provides that the appropriation of \$5,000 by the National Government for the support of forestry instruction and experimentation in the schools and colleges benefited thereby is conditioned upon the

appropriation of a like amount by each state that shall take advantage of its provisions, and the whole amount shall be expended subject to the approval of the Secretary of Agriculture. This would require a total appropriation from the National Government of perhaps \$250,000, a very small amount. This may be met by the statement that these agricultural colleges and experiment stations already receive something over \$700,000 per year from the National Government. To this I would reply that this expenditure has been well justified by the great benefit that has come to agriculture as a result of it. Some single discoveries have already been worth more to the country as a whole than the total of all the appropriations ever made for the agricultural colleges and experiment stations. This money could be used for forestry, but in almost every case it is largely used by, and needed for other lines of agriculture.

When we think of the enormous value of the forest output of this country, the amount requested to educate young men to be competent to take care of this forest wealth seems trivial indeed. I do not wish to see all the agricultural colleges attempting to turn out professional foresters, and such would not be the effect of these proposed expenditures; but the result would be that in a short time we would have a surplus of young men well trained in the basic principles of forestry, through whose efforts the forest sentiment of to-day would crystallize into a permanent and helpful thing.

I have been in my present position in the University of Minnesota nearly

twenty-one years. When I came here in the spring of 1888 there was not a student in the agricultural department; that department was maintained by the state simply for the purpose of getting the national appropriations for this subject, and the whole work was regarded with contempt by practically all the citizens of the state. We have to-day overcome this lack of interest. Last year we had enrolled in our school, college and short course in agriculture, without counting students in any of the other departments, and only those who are required to take the agricultural subjects, over 1,130 students. In that time this institution has grown from a position of inferiority to one of first importance in helpfulness to the people of the state; it is probably our most popular institution of any kind, and the easiest for which to secure appropria-The state has permanently invested in lands and buildings for the carrying on of this educational work and this only, besides the general university work, a total of over \$700,000, a result which has come from the fact that we have not followed precedents established elsewhere but have tried to make our work as helpful as possible to the people of this state. That it has been found helpful is shown by the large number of young men and women who are doing much to bring about improved rural conditions. I am thoroughly convinced that, by the proper education of our young people in forestry, we could do as much for this subiect as has been done for agriculture, and that in no other way can forestry be put upon the most helpful basis.



The Appalachian Forests

The fate of the Southern Appalachian and White Mountain forests, the watersheds of many of the most important rivers of the eastern United States, the sources of a great part of the remaining timber supply of this part of the country, hangs in the balance. Only the intervention of the United States government can save these great mountain watersheds from rapid denudation and keep them for future generations what they have been to the present and past generations

Reservoirs, Timber Farms, Sanitaria and Recreation Places

This is the concern of many states—not of one or two. The task of protection and maintenance is too great for one or two; it is a national job, like reclamation, the Panama Canal, or the improvement of the waterways for the permanence and usefulness of which these mountain forests are necessary.

THE WEEKS BILL

for the acquisition of national forests is a measure of national scope, but in it lies the hope of the Southern Appalachians and White Mountains, the most immediately necessary and definite opportunity for conservation of natural resources now before the American people.

This bill passed the House of Representatives of the Sixtieth Congress by a vote of 157 to 147. It failed for lack of time in the Senate. It is now before the Committee on Agriculture of the House.

There is good reason to believe that it will soon be reported and come before the House for action.

How does your Representative stand on this question?

The small majority of 1909 should be increased. Now is the time to use your influence as a citizen for this measure, a measure of McKinley, of Roosevelt, of Taft, of the people — millions of them.

If you do not know how the Representatives of your state voted send to the American Forestry Association at once for **Bulletin No. 2.**

If you want a stirring argument and a brief for the bill, send for Bulletin No. 1.

If you want a copy of the Weeks Bill send for **Bulletin** No. 3.

If you can use more than one copy of these bulletins, ask for them. They were printed to do good, and there is an abundant supply.

In any case do something

Do not delay

PUBLIC OPINION IS THE LEVER THAT
MOVES CONGRESS

EDITORIAL

What the Weeks Bill Is

WE HAVE been asked to give a brief outline of the provisions of the so-called Weeks Bill, embodying the present form of the Southern Appalachian-White Mountain National Forest project. The full text of the bill was published recently in this magazine, and has been issued as bulletin No. 3 in the general series of the American Forestry Association. In the latter form, single copies can be obtained by application to the office of the Association, and they can also be obtained in large numbers for distribution. Many people, however, desire an explanation of the bill stripped of the verbiage of

its legislative form.

In the first place, it gives the consent of Congress to the states of the Union to enter into compacts to conserve their forests and water supply, and it appropriates \$200,000 to be used by the Secretary of Agriculture to assist any state or group of states when requested to do so in protecting from fire the forested watersheds of navigable streams. Such assistance cannot be given unless the state has itself provided for a system of forest-fire protection and the amount expended in any state in any year may not exceed that appropriated by the state. The Secretary of Agriculture may also agree to administer and protect for a term of years private forest lands situated on watersheds whereon there are national forest lands, and in such cases the owner of these private lands can cut and remove timber only under such regulations as will protect the forest in the aid of navigation.

For the fiscal year ending June 30, 1910, the sum of \$1,000.000, and for each year thereafter until June 30, 1915, the sum of \$2,000,000 is appropriated

for the examination, survey, and acquirement of land on the headwaters of navigable streams, or those which are being or may be developed for navigable purposes. This expenditure is to be made by a commission consisting of the Secretaries of War, of the Interior, and of Agriculture, two senators, and two representatives, which commission is to report annually to Congress. The Secretary of Agriculture is to examine, locate, and recommend for purchase lands which may be necessary to regulate the flow of navigable streams and report to the commission, but before any purchase is made the Geological Survey must have made a report to the Secretary of Agriculture showing that the control of such lands will promote or protect the navigation of streams on whose watersheds they lie. Prices of lands purchased are to be fixed by the commission, and the consent of the state in which the land lies must have been given to the acquisition of such lands by the United States. Mineral and merchantable timber rights are to be reserved to the owners, but the timber can only be removed under rules and regulations expressed in the instrument of conveyance. Agricultural land included in the takings may be set apart and sold as homesteads in tracts not exceeding eighty acres under rules prescribed by the Secretaries of Agriculture and the Interior.

The lands so secured are to be held and administered as national forest lands; civil and criminal jurisdiction is not affected by such administration except so far as offenses against the United States are concerned; and five per cent of all income from such national forest shall be paid to the state in which it is located to be expended for public schools and public roads in the counties in which the forest is sit-

vated. An annual appropriation, not exceeding \$25,000, is made for the expenses of the commission and its members.

These are the provisions of the act in outline. It will be noticed that it nowhere mentions any specific localities in which such forests are to be acquired. It is, therefore, an act of general, national application and its special application to the two Appalachian areas is simply due to the fact that they are known to be the most important forest regions in the East for the purposes of this act. It is believed by many of the best friends of the Southern Appalachian and White Mountains that a broad, national measure of this kind is better than one that is specific, and this is certainly true as far as general principles of legislation are concerned. As originally introduced in the Sixtieth Congress, and as it passed the House in that Congress, the Weeks Bill had a duration of nine years instead of five. We believe that it was better in that form and that a period of time as long as nine years is needed to demonstrate in the most complete manner the need and value of these forests for national purposes. change was probably made in order to facilitate the passage of the bill hrough Congress, and in the belief, which we hope is well founded, that within five years its usefulness would have been sufficiently demonstrated to establish the policy.

Whatever differences of opinion there may be upon special features of the bill, it must be remembered that it is the product of the careful study of some of the ablest men in the House of Representatives, and that they have also consulted with some of the senators who have been particularly interested in this measure, and that the bill is the form of legislation which they believe to be most practicable. It is, therefore, necessary that all friends of the great object towards which this bill is directed should put their shoulders to the wheel in the united effort to push it through

to the long-sought goal.

The Report of No. Necre

HE translation from the Revue des Eaux et Forets of Paris, which is published elsewhere in these pages, is of peculiar interest at this time because it reviews the work and conclusions of some of the French and German investigators who were cited mistakenly, we believe, to support some of the contentions of Mr. Willis L. Moore, the Chief of the Weather Bureau, in his recent report on the influence of forests on climate and on floods. It appears from this French review of the discussions of the Milan conference, as well as from the testimony of Professor Swain at the hearing before the Committee on Agriculture on the 25th of February, that the judgment of the foreign investigators is practically unanimous in opposition to the position taken by Mr. Moore and some of the army engineers. Next month we shall publish in AMERICAN FORESTRY a symposium by some of our best American authorities dealing with Moore's report.

The attention that has been given to this somewhat remarkable document is out of all proportion to its scientific value, but when a man who is known as the Chief of the United States Weather Bureau issues such a report upon a subject that is of vital interest to the whole country, and that bears upon many of its most important questions, the public as a whole is likely to estimate the statement by the position held by its author, without a close examination of his authority, his qualifications to judge of the subject in hand, or the scientific accuracy of his reasoning. On these points it may be said that whatever position may be accorded the Chief of the Weather Bureau as a meteorologist, he has not qualified in any respect as a physiographer or as a forest engineer, and the men who have so qualified have a right to contradict his conclusions, as they almost unanimously do. Mr. Moore consciously and intentionally considers

the subject solely from the standpoint of his special field. Note this statement: "The run-off of our rivers is not materially affected by any other factor than the precipitation." To say this is to shut one's eyes to many factors which affect the run-off of rivers and which are known to every observer, even to those who are not trained in scientific methods of investigation.

But it is not our intention to discuss the details of Mr. Moore's report. We have made provision for doing that in the pages of this magazine by the most competent hands. We wish to say a word of the circumstances under which this report was made and the apparent animus behind it, both of which are of interest to the country as a whole, since the report has been very widely distributed, and have some bearing upon the estimate we may make of its value. We are told that "when Prof. Willis L. Moore was before the Committee on Agriculture of the House of Representatives in 1909, to explain the estimates for the Weather Bureau, a discussion arose as to the influence of forests on climate and on the run-off of Professor Moore stated that he was then making some studies on the subject which might lead to some definite conclusions, and he was requested by the chairman of the committee to continue these studies and make a report when they were concluded. This has been done, and the report submitted by Professor Moore, which follows, is printed by the direction of the committee." It is not explained what the relation of this discussion was to the question of estimates for the Weather Bureau, nor why Mr. Moore, a bureau chief in the Department of Agriculture, should be privileged to issue a special report of this kind bearing upon the work of other bureaus of his own department and of a coordinate government department, under authority of a congressional committee, and without the authorization of his chief, when other

chiefs of the bureaus of these departments were barred by executive order from discussing his conclusions or making any reply thereto. In a speech by Hon. Charles F. Scott, chairman of the Committee on Agriculture, delivered at the Boston City Club about a year ago, Mr. Scott spoke of Mr. Moore as "one who could sing the birds out of the trees," and intimated that when Mr. Moore appeared before his Scott's) committee to ask for anything, he generally got pretty nearly what he asked for. Does this remarkable statement have any bearing upon the fact that at a time when other bureau chiefs are kept in leash by executive authority, Mr. Moore is permitted to issue a report upon a general question and to introduce into that report the remarkable series of italicized clauses which apparently are directed at certain legislation to which the chairman of the Committee on Agriculture has shown most determined hostility? It is well known that Mr. Moore's conclusions are not those of the best authorities on the subject in the Forest Service or in the Geological Survey, yet they must keep silence while Mr. Moore's report is sent broadcast under frank and every available mailing list is utilized to give it the widest possible circulation.

There is neither honesty nor fair play in this method of procedure, and in view of the fact that the recognized authorities in the Government service cannot talk, we propose through this magazine and through the bulletins of the American Forestry Association to spread as widely as Mr. Moore's report has been spread the opinions of the best authorities on this question whom we have in this country. In doing this we believe that we shall simply be performing the public duty which the American Forestry Association and this magazine owe to the people. All that we ask for is a fair discussion and an open forum. Mr. Moore has attempted to speak his piece in a closed forum. We propose to throw the doors wide open.

The Lesson of Canada

T ONE of the sessions of the Canadian Forestry Association held last week at Fredericton, New Brunswick, the chairman of the Canadian Conservation Commission, Hon. Clifford Sifton, made an address of much interest to us on this side of the line. We are accustomed to think of Canada as a country of big woods and inexhaustible timber supply, looking at it in much the same careless fashion that we have been wont to regard our own conditions until we were aroused, most of us, to the actual situation. Not long ago a German forest expert was sent to Canada to report on conditions there, and his report was to the effect that other countries could not look to Canada for their timber supply, that our northern neighbor needed all of her own product for her own uses, and was coming to realize it. This German report was cited at length by the British Royal Commission on Afforestation, in its able and instructive report recommending the reforestation of 9,000,000 acres of land in England, providing a detailed plan for financing and carrying out this work through a series of years, in order that England might produce its own timber and become independent of foreign countries.

In the address referred to, Mr. Sifton called attention to the fact that the United States cannot supply itself with wood for more than thirty years, and declared that "should it become necessary for the United States to look to Canada for a further supply of wood, all the merchantable lumber in Canada's forests would be exhausted at the end of seven years." We quote from the press report. Mr. Sifton expressed the opinion that within the present generation it would be necessary to place legal limitations upon the quantity of lumber to be cut, and he believed in making a beginning of that policy at once. Ontario already compels all timber cut on government lands to be manufactured

in the province. This policy has brought into Canada from Michigan many mills that formerly manufactured Ontario timber in that state. Quebec proposes to adopt a similar policy, and Mr. Sifton urged it upon the consideration of New Brunswick. He did not believe it to be wise for the government to dispose of the fee in its timber lands. When so disposed of they became subject to taxation by the state, which to obtain as large a revenue as possible fixed a high rate which encouraged lumbermen to cut the timber as rapidly as possible. The Dominion policy is to lease land on renewal terms and to continue the leases as long as the lessees live up to the terms of the leases.

Mr. Sifton urged the association to favor the establishment of forest reserves on the eastern slopes of the Rocky Mountains, because unless something were done to preserve the forests there the country would be flooded at one season of the year and become a barren waste at another. Evidently, the distinguished Canadian had not heard from the United States Weather

The moral of all this is that, like all the rest of the civilized world, Canada is measuring her timber resources and preparing to protect them by progressive and drastic measures against exploitation for the benefit of wasteful foreign countries, including her next-door neighbor. We cannot look to the north for our salvation. We must husband all our remaining resources and plant trees wherever they can be grown more profitably than other crops, in order that our own future may be assured. That is the only way. Canada has not the resources for her own needs and ours too, and she is sufficiently wide awake and intelligent to guard her own. The only way that our timber resources and Canada's can be made inexhaustible is by the application of the highest scientific knowledge and the broadest common sense.

THE NATIONAL FORESTS

National Forests and Stream Protection*

By F. A. FENN Supervisor, United States Forest Service

"Forest conservation" is a broad term, comprehending far more than mere "timber preservation," which is often mistakenly regarded as an equivalent expression. true that we cannot preserve our timber so as to have a continuous supply of timber products without conserving our forests; but it is also true that without conserving the forests we cannot maintain an equable flow in our streams for the steady generation of a maximum of power; for the realization of the greatest benefit in irrigation, and for the highest utilization of our rivers for purposes of trade and commerce, matters of supreme public importance that may be vitally affected by forests which contain little or no timber of merchantable character. Our national forests, the so-called forest re-serves, are established for the conservation of all the potential forest resources, not for the preservation of timber only. No fact is better established than that the forests provided by Nature as a protective cover for the water-sheds of rivers are the best pos-sible regulator of stream-flow. Maintain that cover and the rivers will be most efficient in the discharge of those functions so beneficial to mankind; destroy it and they become relatively inefficient or positively injurious and destructive because of erratic flow. As an example, I need only refer to the Ohio River, where, in consequence of the denudation of its drainage basin, the navigability of the stream has been greatly impaired and the destruction of property by freshets and floods now annually reaches millions of dollars. The Inland Empire has for nearly a half-

The Inland Empire has for nearly a half-century hoped for an all-water route to the sea. Thanks largely to the efforts of your people here, that hope is at last practically realized, and the Snake River from Lewiston to the Columbia is an important part of that route. Have you considered the fact that the total amount of water appropriated for irrigation purposes from the Snake River and its tributaries above Huntington, Oreg., exceeds the mean low-water flow of the river at Huntington Bridge? Within a very few years, when the great reclamation schemes of South Idaho now in course of development shall have been put in full operation, unless some system different from what is now

outlined be adopted regarding the waters of that great stream, the Snake River at Huntington will cease to deserve the name; its bed will be practically dry for a good part of every season, its waters diverted to subject the desert to the beneficial use of man. We wish our neighbors of the South the fullest measure of success, prosperity, and happiness, but we must remember that what they are doing directly and injuriously affects the navigability of the Snake River below Lewiston. We cannot complain at that, but it compels us to be the more careful in conserving the supply of water for naviga-tion that is available from other sources. Below Huntington every considerable affluent of the Snake has its headwaters protected from denudation and injurious use by the national government through the establish-ment of national forests. The most important of these tributary streams are the Salmon and Clearwater rivers, whose vast drainage basins nature has clothed with magnificent sylvical growth. Properly managed, conservatively handled, the forests there will produce enormous quantities of timber indefinitely and at the same time perform the many other functions to which they are so admirably adapted, and chief among which is the maintenance of a stable, uniform streamflow. On the contrary, if they be abused or neglected, if they be exposed to uncontrolled. unregulated use by those who look for quick profits and personal aggrandizement rather than ultimate good and public benefit, the forests will be devastated, the timber supply will quickly be exhausted, the flow of the rivers will become irregular and uncertain. their capacity to generate a steady amount of power for the multitudinous uses of the people will be impaired, your labors in the cause of Snake River navigation will be rendered vain, and the all-water route from Lewiston to the sea will be but the memory of a Much as it is to be desired that every branch of industry should be established and made to prosper in this city, it would be a shortsighted policy that would encourage the exploitation of the forests upon which reliance must be had for a navigable stage of water in the Snake River from here to the Columbia for the longest possible time every year. Do not allow the prospect of a great temporary lumber in-dustry at this point or elsewhere in this section to blind you to the incalculable permanent good to the whole community that

^{*}This article is the substance of an address delivered by Major Fenn May 19, 1909, in Lewiston, Idaho.

will result from a careful, systematic conservation of the forest resources of the empire drained by the great rivers at whose confluence you are situated; better, far better, that many small lumbering plants should be operated all over the interior country under regulations that will assure the conservative use of timber products, avoid monopoly, guard against waste, and prevent the destruction of forest conditions upon which more than upon any possible exclusive timber business the continued growth and prosperity of Lewiston and her tributary territory depend.

Conserve the forest resources, guard them jealously, keep your rivers open and in the highest state of utility for purposes of trade and commerce, hold them as great public highways. Above all, insist upon it that the forest conditions favorable to the maintenance in these streams of a stage of water suitable to unimpeded navigation shall be preserved and continued, and Lewiston will attain to the proud position among the cities of the West for which her natural location and surroundings so eminently fit her; and, at the same time, the entire interior will benefit by what you do and reciprocally enhance your prestige and material prosperity.

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The National Forest Boundaries

As a result of the examination last summer of national-forest boundaries much land not suited to forest purposes along the edge of and within national forests will be restored to the unreserved public domain, in accordance with a plan submitted to the President by the Secretaries of Agriculture and of the Interior. Maps and reports now in the pos-session of the Department of Agriculture show the nature of the lands and cover along the national-forest boundaries and within the forests. This information was secured in order to rectify the boundaries, since it was never intended that the national forests should include agricultural lands, or grazing lands not suitable for forest purposes. To obtain it involved going over about 60,000 miles of boundaries. The report to the President follows:

February 7, 1910. THE PRESIDENT, The White House.

Sir: After having very carefully considered the matter of eliminations from the additions to the national forests, we respectfully recommend that the following general policy be adopted:

1. Lands wholly or in part covered with brush or other undergrowth which protects stream-flow or checks erosion on the water-shed of any stream important to irrigation or to the water supply of any city, town, or community, or open lands on which trees may be grown, should be retained within the national forests, unless their permanent value under cultivation is greater than their value as a protective forest.

2. Lands wholly or in part covered with timber or undergrowth, or cut-over lands which are more valuable for the production of trees than for agricultural crops, and lands densely stocked with young trees having a prospective value greater than the value of the land for agricultural purposes, should be retained within the national forests.

3. Lands not either wholly or in part covered with timber or undergrowth, which are located above timber line within the forest boundary or in small bodies scattered through the forest, making elimination impracticable, or limited areas which are necessarily included for a proper administrative boundary line, should be retained within the national forests.

4. Lands not either wholly or in part covered with timber or undergrowth, except as provided for in the preceding paragraphs, upon which it is not expected to grow trees, should be eliminated from the national forests.

We have the honor to be, very respectfully, Your obedient servants,

(Signed) James Wilson,
Secretary of Agriculture.
(Signed) R. A. Ballinger,
Secretary of the Interior.

On the whole, the changes which are found to be called for are of relatively minor importance, but in their aggregate they open to settlement a large amount of land. The application of the rules which the President has approved will mean the early restoration to the public domain of 4,000,000 acres or more of national-forest land. This is something over two per cent of the total national-forest area. Three-tenths of the forests have yet to be mapped.

Some of the land is suitable for dry-land agriculture, though the greater part is grazing land. In Idaho, which has a large national-forest area, about 470,000 acres will be eliminated, of which thirty-four per cent is tillable. Eliminations in similar proportion will be made in a number of the other western states which have large amounts

of land in national forests.

STATE WORK

Kentucky

A bill has been introduced in the legislature the provisions of which are thus summarized by the Louisville Courier-Journal:

"A board of forestry shall consist of the governor, the director of the Kentucky Ex-periment Station at Lexington as ex-officio members; the state forester, a trained man appointed by the governor, with the advice of the senate, and four members similarly

appointed.
"The forestry board shall have the care and control of state reserves hereafter to be acquired, shall ascertain the best methods of reforesting cut-over lands, foresting waste lands, preventing destruction of forests by fire, administering forests upon scientific principles, instructing private owners in practical forestry, and conserving timber on the watersheds of streams.
"The board shall be allowed to purchase

reserves at a price not above \$5 an acre, to receive gifts of land and money for forestry purposes and as a breeding place

The board shall secure and publish in popular form information as to the best methods as to conserving the forest and water supply.

"The state forester shall, when directed, cooperate with counties, corporations, municipalities, and individuals in conservation work. "The salary of the state forester is fixed

at a maximum of \$2,000 a year and reasonable traveling expenses.'

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Louisiana

John H. Foster, forest assistant of the United States Forest Service, is making an examination, with Register Grace, of the state land office, of the Louisiana forests, for the purpose of preparing a report to the general assembly looking to their maintenance. Mr. Grace has collected much data through the assessors, and a thorough personal sursey of the state will also be made. Considerable attention is to be given to the denuded pine lands.

At its annual meeting in January the Louisiana Forestry Association elected the following officers: President, Henry E. following officers: Hardtner of Urania; vice-presidents, W. O. Hart of New Orleans, E. A. Frost of Shreve-port, T. C. Wingate of Leesville; secretary, Mrs. A. B. Avery of Shreveport; treasurer, Robert Roberts, Jr., of Minden; councillors

at large, Mrs. J. D. Wilkinson, Shreveport; Harry P. Gamble, Winnfield; M. O. Lambly, Jennings; executive council, Charles P. Johnston, New Orleans, first congressional district; Grace King, New Orleans, second congressional district; Professor Alleman. Baton Rouge, third congressional district; Thomas J. Davis, Leesville, fourth congressional district; J. W. Elder, Farmerville, fifth congressional district; Fred J. Grace, Baton Rouge, sixth congressional district; H. H. White Alexandria, seventh congressional district.

The following resolution was adopted: "Be it resolved by the Louisiana Forestry Association, in regular meeting assembled, that the general assembly of the state of Louisiana is hereby urged and requested to appropriate sufficient funds to maintain the chair of forestry at the Louisiana State University created by an act of the general

assembly.'

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Maryland

The report of F. W. Besley, state forester of Maryland, to the governor, states that in the last three years the work of making a forest survey of the state has been completed in eighteen of the twenty-three counties.

Forest conditions in eight counties—Somerset, Dorchester, Talbot, Caroline, Anne Arundel, Baltimore, Howard, and Mont-Arundel, Baltimore, Howard, and gomery-have been carefully studi studied, resulting in detailed forest maps showing location of all woodlands, character and conditions of growth, stand and value of timber, reliable data as to uses of timber and observations in bettering the methods of forest

management.

The forest-warden system inaugurated three years ago has been improved and made more effective for the suppression of forest During the last year thirty of the eighty-three fires reported were extinguished by the forest wardens at a total cost of \$367. The present forest protection system, as imperfect as it is with unpaid wardens, has accomplished an immense amount of good in making people more careful about fires and in suppressing before much damage is done those that occur.

"The rapid exhaustion of local timber resources," says Mr. Besley, "is a serious question. Other states are much in the same predicament. We must eventually depend on our own forests for most of our timber supply. Under present conditions, through wasteful and injudicious methods of cutting

and as a result of repeated forest fires, our woodlands are deteriorating so that they are producing but one-third or one-fourth of what they are capable of doing under proper and reasonable management.

"Since the woodlands are almost entirely in private lands, improvements must be effected by educating owners to the importance of improved methods of management to secure the greatest permanent revenue

and to pass this valuable resource unim-paired to the next generation."

The state owns four forest reserves aggregating 1,957 acres, which have been placed under systematic forest management to serve as object lessons of what forestry is and what it may accomplish. These re-serves under the care of the state board of forestry will in a few years pay the cost of maintenance and eventually pay a revenue to the state.

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Maine

A Maine legislative commission is investigating the practicability of harnessing 530,000 horse-power in waterways under state control. This is probably the reason for Representative Guernsey's proposed modification of the Weeks Bill, permitting the states to enter national forests to establish and control water-powers therein.

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Massachusetts

The grave menace which the imported gypsy and brown-tail moths have been and are to the trees and woods of Massachusetts, together with the danger that if not controlled they may become a national nuisance. attaches great interest to the work going on in the Bay State to assure this control. It is generally conceded that the ordinary physical means of fighting the spread of the pests are only emergency measures and too costly to be a permanent dependence. ultimate hope of the regions now or likely to be infested is in the introduction of natural enemies that will keep the gypsy and brown-tail in check without themselves doing damage. Much work has been done along this line, under the direction of Dr. L. O. Howard, of the National Bureau of Entomology, cooperating with the Massachusetts forest service. Some interesting details of the work are given in a recent interview, in the Boston Post, with W. F. Fiske, the expert in charge of the state laboratory at Melrose Highlands, Mass. Mr. Fiske is an interesting talker on his subject, modest and unassuming; but an expert who knows his

There have been introduced into the United States some fifty sorts of parasites that prey upon the two destructive moths, and of these fully forty-five have been turned loose in

Massachusetts. They range from the tiny Shedius, a chalcid fly, which resembles a midge, or black fly, and which invades the egg of the gypsy moth, to the big black and green beetle, known as the Calosoma beetle, which eats the caterpillars alive. Between these extremes are such versatile parasites as the Glyplanapanteles fulvines, a fly that attacks the caterpillar at all stages of development. For five years, now, these various natural enemies of the gypsy and brown-tail moths have been introduced into Massachusetts and the question raised has always been as to their efficiency in a new environ-

"What we intend to do this spring and summer," says Mr. Fiske, "is to find out just how great has been the increase in these parasites. We feel rather confident that this increase has been even larger than we counted upon at the beginning. For instance, in the case of the Monodontomerus aereus, which was introduced in 1906, we found a year ago last spring only twelve of these parasites to 1,000 brown-tail moth nests examined. Last spring we found 350 of these parasites to 1.000 nests. This estimate was based on examination of caterpillar nests in search for eggs of the parasites. We look for a proportionate increase in other destructive agents, but we know well enough that to find certain of the parasites, such as the tachid flies, is difficult. A great many persons interested in the work we are doing have said that they have not noticed the parasites, and the reason is simply that either the parasites keep out of sight or that some of them so closely resemble certain common insects that the average person does not mark the difference. The tachid flies look very much like common house flies at first glance.

"We have spent a great deal of time and money in propagating and distributing parasites, and now we are going to take stock, so to speak. Many persons think that when parasites are liberated in a certain district, they must of necessity clean that district of moths and caterpillars before they move on or increase in numbers so that they cover other districts. This idea is wrong, for there is no way of controlling the insects, and we find that sometimes they do their best work at a remarkably long distance from where they were distributed. Various elements may enter into these unexplainable immigrations, and the one reassuring fact is that in some cases they may forestall the moths in localities and be there to meet the pests when they arrive. In going over the ground this spring we shall be able to find out whether the parasites are doing what they were brought here to do, and if they are not we shall remedy conditions by bringing in other sorts with which, up to the present, we have scarcely done more than to experiment."

Regarding some of the more interesting destructive agents with which Mr. Fiske and his collaborators have been working, there is much to be said for the big calosoma beetle. In appearance it is a hard-shelled insect, almost as large as a miller's thumb, and colored in iridescent hues, with green pre-dominating, as in the so-called scarabs, or sacred Egyptian beetles. In speaking of the

beetle, Mr. Fiske said:

"The chief objection to giving too much attention to this beetle has been the length of time it requires to propagate. The moth pest needed quick action, and the generation of the beetle is about three years. Nevertheless, they are known to live for several years, retiring before cold weather into cells they dig in the earth. The periods of ac-tivity of the adult beetles correspond in a general way to those of the gypsy moth, and they feed voraciously on the live caterpillars. They appear to seek out the places where the caterpillars are plentiful, and there they remain to feed on them. The eggs of these beetles are deposited in the earth near the base of trees infested by caterpillars, and as soon as the larvæ hatch they climb the tree in search of their prey. Even at this stage they are strong and active enough to attack the full-grown caterpillar of the gypsy moth. When the pupæ of the beetle are thus supplied with food they grow rapidly, molting twice before reentering the earth, where they undergo the subsequent transformations to pupæ and the adult form."

New York

In connection with the investigation in New York into the forest land purchases of the state, Commissioner James S. Whipple states that he estimates the amount spent by the state for this purpose at about \$3,500,000. His report recently presented to the legislature shows that the state's holdings of forest lands aggregated on January 1, 1,841,523 acres, which included 1,530,559 acres in the Adirondacks and 110,984 in the The state entered upon the Catskills. policy of purchasing forest lands in 1897. which was the first year of the administration of Gov. Frank S. Black. Governor Hughes has appointed as commissioners for the purpose of investigating the management and affairs of the state forest, fish and game commission, and the purchases of land made by the state within the forest preserve, Roger P. Clark, his legal adviser, and H. Leroy Austin, district attorney of Greene County. The investigation has the full approval of Commissioner Whipple. No specific charges have been filed, but since the Allds-Conger bribery scandal developed criticism has been directed against certain transaction in connection with the purchase of forest lands which the governor felt could no longer be The governor is greatly interested in the possibilities of the forest reserve and in the development of the water-powers of

the state and believes that the people have a right to know that their money, which goes to add to the forest reserve, is being hon-

estly expended.

One of the largest spring water companies in New York State has been reforesting land for several years to protect its springs and maintain the purity and regular supply of water. In a letter to Commissioner Whipple of the forest, fish and game commission, it reports planting approximately 350,000 trees, consisting of Scotch pine, white pine, bull pine, red pine, larch (commonly called tamarack), arbor vitae or white cedar, balsam, and hemlock. This work covers an area of over 300 acres. A very large percent the trees has lived, the exceptions A very large percentage of those that were purchased in poor condition; but these exceptions do not apply to any state nursery trees, all the native product having been in uniformly good condition. Scotch pines set three years ago show a fine growth, many reaching a height of three feet. In some instances eighteen inches growth was added the past summer.

Through Commissioner Whipple's efforts

180 private parties planted 1,200,000 trees last year and practically every purchaser reports ninety per cent of the trees living.

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Oregon

The Oregon state board of forestry plans an active educational campaign for the coming year. A report by the secretary of the board shows the number of forest fires in the state during 1909 to have been 413, burning over an area of 61,037 acres, classified as "Merchantable timber, 33,137.5 follows: acres; second growth and not yet merchantable, 5,607.5 acres; cut-over land, 22,202 acres. A total of 191,213,590 board feet of merchantable timber was destroyed in these The timber destroyed represented a fires. value of \$2,485,776.67 if it had been manu-During the year about \$45,000 factured. was expended in fighting and preventing forest fires in the state. Of that amount, individuals and lumber companies contributed approximately \$40,000, the forest service spending only \$5,220.84 for this work.

"While Oregon had only 413 forest fires during the year, Washington had 1,309 fires," said Mr. Wastell. "At the same time, the state of Oregon sustained a loss of nearly 200,000,000 feet, board-measure, of standing timber, while Washington, with three times as many fires, only lost about 150,000,000 feet

of standing timber.
"The hazard in Washington was greatly accentuated by reason of a very dry season and a large proportion of the fires were caused by sparks from locomotives. The cost of fighting fires, as paid by individuals, is as complete as it was possible to obtain. While the state of Washington assumed \$15,-

705 of the expense of fighting fires in that state, the state of Oregon spent no money in

that direction.

"This study of comparisons is very interesting. The splendid showing in Washington, considering the large number of fires and the comparatively small amount of timber destroyed, is due to the organized effort of private timber owners through the medium of the Washington Forest-fire Association, as well as to the state and govern-ment, which participated so generously in this work.

"A few big fires in remote sections of

Oregon continued burning for weeks, covering a large area, while in Washington the fires were subdued promptly through having fire-fighting forces available. Oregon's lack of preparation would have resulted in a tremendous loss if a corresponding number of fires had started in this state.

The members of the state board of for-estry are: Governor Benson, R. O. Stevenson, game and forestry warden; H. C. Mc-Allister, master fish warden; S. C. Bartrum, of Roseburg; L. S. Hill, of Cottage Grove; Prof. E. R. Lake, of Corvallis, and A. B. Wastell, of Portland.

EDUCATION

Colorado School of Forestry

The Colorado School of Forestry was founded in 1905 by gifts from Dr. William A. Bell and from the late Gen. William J. Palmer. It is particularly fortunate in possessing a tract of 13,000 acres of forest land at Manitou Park, about twenty-five miles west of Colorado Springs near the line of the Colorado Midland Railroad. The forest on the school land consists mainly of western yellow pine and also of a small amount of Douglas fir. On account of the good market for forest products in the vicinity of Manitou Park, it is possible to practise very intensive methods of forestry. A sawmill is located on the school land at the present time to cut the over-mature and defective

The faculty of the Colorado School of Forestry, was increased this fall by the addition of two professors in forestry and lumbering who not only are graduates of the Yale Forest School, but have each had several years of administrative work in the Forest Service on the national forests in Colorado. The faculty has therefore for the instruction in forestry and lumbering both the advantages of complete technical training and of long experience in the actual practise of forestry. In addition to the two professors who teach forestry and lumbering, the faculty includes members of the faculty of Colorado College, of which institution the forestry school is a department. The regular course of the Colorado School of Forestry covers four years and leads to the degree of Forest Engineer.

The aim of the school is to give a thorough

training to students who intend to adopt forestry as a profession and to fit them for positions in the government Forest Service, for positions as state foresters, or

for private employ as expert foresters. Although an undergraduate course does not give the student opportunity to make as complete study of the academic courses, the curriculum at the Colorado School of Forestry includes all the subjects in forestry and allied sciences necessary for thorough training of technical foresters. The Colorado school has the unique advantage of being located within easy reach of several national forests, and its students have therefore ample opportunity to inspect the most extensive work in practical forestry which can be found in the country. In addition to this great advantage, the location of the school in the West not only gives prospective for-esters from the East who contemplate positions on the national forests opportunity during their college years to become familiar with western conditions of life, but also gives western young men opportunity to study forestry without undergoing the expense of a long journey to the East.

The total enrolment of the Colorado School of Forestry this fall was thirty. Of the seventeen members of the entering class, several are from Massachusetts, Pennsylvania, and other eastern states. The class of 1910, which will be the first to graduate, has four

members.

The first lumbering trip has just been completed. The Seniors, with Prof. P. T. Coolidge, spent ten days early in December among the sawmills and logging camps near Fraser on the Arapaho National Forest. Fraser, a small town about eighty-five miles from Denver on the Moffat road, is the center of a considerable lumber industry, and is the headquarters of the Arapaho National Forest. This lumbering trip, which is to be an annual institution in the school, is part of the policy of teaching forestry and lumbering as much as possible in the lumber woods.

THE APPALACHIAN FOREST CAMPAIGN

The hearing on the Weeks bill, which is quite fully reported in other pages of this magazine, was continued on Tuesday and Wednesday, the 1st and 2d of March, in order to hear the testimony from Mr. Willis L. Moore, Chief of the Weather Bureau, and from some of the army engineers. The first witness at the Tuesday session was Major J. D. Cavanaugh, Assistant Chief of Engineers. Major Cavanaugh has had several years ex-perience with rivers in Georgia and Alabama and testified with great fairness and moderation as to the opinions which he had formed from this experience. Major Cavanaugh was extremely frank in his statements and showed an entire lack of prejudice and a desire to be perfectly fair and to speak as a scientific and practical man rather than as a proponent of any theory. One of his most notable statements was to the effect that there is no question as to the protection of slopes by forests. "That," he said, "is one of the primary uses of forestry," and he cited France as a notable example.

Mr. Moore followed Major Cavanaugh.

Mr. Moore followed Major Cavanaugh. He recited his education and scientific training and experience and presented letters indorsing the position which he had taken in his recent report. Mr. Moore did not stand up well under the searching cross-examination of Representatives Lever and Plumley of the committee. Professor Swain was also present at the hearing and asked Mr. Moore some troublesome questions from the knowledge of a scientific expert. Mr. Moore acknowledged during the questioning that he was not a geologist, nor a forester, nor a hydrologist, admissions which weaken his authority on the subject dealt with in his

On the following day, Major W. H. Bixby, of the Corps of Engineers, and Capt. E. N. Johnson, of the same corps, testified. Major Bixby, an able officer and engineer, spoke mainly of his experience with the Mississippi and Missouri rivers, and his position was that which has become well known through the discussions by Colonel Chittenden and others as the position of the majority of members of the Engineer Corps. Colonel Bixby did not, however, apply his reasoning or his facts directly to the conditions in the Appalachian Mountains, his argument continually going back to the conditions which are peculiar to the Missouri and Mississippi.

Captain Johnson disclaimed any intention of advancing opinions or statements of his own, but appeared to lay before the committee certain reports and documents which were in the hands of the Corps of Engineers, his purpose being apparently quite as much to defend the engineer corps from charges of unwise expenditure of the public funds as to present any points in regard to the Weeks Bill or any other legislation. His statements were clear and well put, and he presented a strong case for the achievements of his corps. He was the last witness to appear before the committee. It was made clear that as regards navigation the army engineers generally pin their faith to work on the channels of streams and to bank protection, and have little faith in forestry; but on their own admissions the case as regards forest protection is still an open one, on which the authorities are divided.

It is improbable that any votes in the committee were influenced by the hearings, but it is understood that some members of the committee agree with the position taken by Mr. Weeks, that this bill really belongs to the House, and will vote to report it regardless of their personal views and the action they may take individually on the floor of the House.

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A Clear Cut Resolution

The following strong resolution was adopted by the American Civic Association at its Cincinnati meeting, November 16:

"We reiterate our demand upon Congress for the establishment of National Forest Reserves in the northern and southern Appalachian regions, believing that this is a national issue, beyond the effective jurisdiction of any state or group of states, and vital to the welfare of almost the entire eastern half of the United States, and that every year's delay in their establishment adds mightily to the penalty of indifference that the Nation must pay."

This association, with its national scope and interests, representing the best public spirit of the country, has steadfastly supported the Appalachian National Forests project. The case has never been presented in the same number of words better than in

this resolution.

NEWS AND NOTES

The Weyerhaeuser Idea as to Reforestation

"We believe that the only way in which the forests are likely to be replaced is for the state either to buy the lands from the lumber companies at a small price and replant the cut-over areas or remit the taxes. It is a simple mathematical demonstration that it will not pay the lumber corporations to keep up tax payments and wait for a new crop of trees on cut-over lands. When the taxes are added and the value of the timber is computed, it is only a two per cent investment and business men are not looking for that kind."

George S. Long, western representative of the Weyerhaeuser Lumber Company, which owns more than 3,000,000 acres of timber land in Washington, Oregon, and Idaho, made the foregoing reply in an interview when asked if the syndicate is making any effort to reforest cut-over land, and if it objected to paying taxes on the latter.

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A Municipa Forest

The city of Vallejo may soon become the pioneer in municipal forestry in California. It will be if the city council acts favorably upon a recommendation made by the Merchants' Association of that city.

Vallejo owns its own water system, and several thousand acres of land in Wild Horse Valley, the source of the water supply. This land is now practically worthless, and produces no revenue for the city. The Merchants' Association has proposed to the city council that the city plant 500 acres of this land to eucalyptus trees. The association figures that in ten years the city will have 250,000 matured trees, which, at a value of \$5 each, will be worth \$1,250,000. Thus in a few years this tract of land would be a permanent source of revenue and would reduce taxes to a minimum, perhaps doing away with city taxes completely.—Times, Visalia, Cal.

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Fighting Forest Fires

Sometimes they do things very well in Michigan. As every one is aware, Michigan, like New Hampshire, is very solicitous for her forests. Again, like New Hampshire, Michigan is disturbed from time to time by forest fires, and every loyal Michigander is expected to prove his willingness, whenever occasion may demand, to join his neigh-

bors in fighting those fires. In fact, a Michigan statute specifically provides punishment for refusal to assist in suppressing a forest fire. Never, however, until last week has it been found necessary to invoke this statute, and then a man was sentenced to ninety days in the Detroit house of correction.

* * * It is always to be expected that careful judgment will be exercised in the enforcement of this law, as of any other; and reasonableness in the application of this law, as well as public spirit on the part of the men of Michigan, is implied in the statement that no person had ever before been punished for refusal to fight forest fire in that state.—Manchester (N. H.) Union.

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Drop in Lumber Output

According to the report of the Census Bureau on lumber, lath, and shingles, there was a heavy decrease in the cut and value of those articles for 1908 over the previous year. The value for 1907 is placed at \$897,-941,736, while for 1908 the value is placed at \$698,262,175, a decrease of about \$200,000.000.

The smaller production was due to the business depression and to the decrease in the acreage of marketable logs. The average price of lumber from the mills is reported by this bulletin to have been \$15.37, as compared with \$16.56 for 1907.

There was an increase of 2,381 mills and a decrease of over 7,000,000,000 feet in the

output for the year.

The state of Washington is still in the lead in the production of lumber, the bulk of its cut being from the Douglas fir. Louisiana is a close second, its output coming from yellow pine and cypress. Mississippi ranked third and Arkansas came fourth. The bulletin gives Michigan first place for the total cut of lumber since saw mills were set up first. The Wolverine state has about 100,000,000,000 feet of lumber to its credit. Wisconsin comes second with about 75,000,000,000 feet.—Washington Times.

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A Forestry Course

A new four-year course in forestry has been added to the courses given in the College of Agriculture of the Ohio State University. There is an enrolment of twenty-eight students. Of this number eleven are freshmen and seventeen transfers from other courses.

Trees and Railroads

The suggestion that railroads plant rows of trees on either side of their tracks does not appeal to the Cincinnati Times-Star, which sees in such a plan a serious obstruction to the view of passengers, and added opportunity for collisions. It says:

"The conservation of the natural resources of this country in general, and reforestation in particular, are matters of the greatest importance and interest to every American who has his eye open to the needs of his country. But this idea of planting trees alongside of railroad tracks is more impressive on first suggestion than after it has been thought over a little.'

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Effect of Oxygen in Coal

Recent investigations by the United States Geological Survey have shown that oxygen, so essential to all life, forms in coal an impurity that is almost as injurious as the ash content. The subject is, of course, of great importance to the consumer, whether he be a manufacturer using hundreds of tous or a householder who has to supply only a

David White, an account of whose investigations on the subject has just been published by the Geological Survey as Bulletin 382, was led to these conclusions in the course of work undertaken in an attempt to devise an acceptable classification of the many different sorts of coals. He states that oxygen and ash are of very nearly equal negative value, ash being probably a little more injurious in most coals; and that the calorific value of coals in general is indicated by the balance between the total carbon on the one hand and the sum of the two great impurities, oxygen and ash, on the other. The practical application of these statements appears in considering the effect of the exposure of coal to the weather. The weathering of the lower grades, especially lignites, bituminous coals, and peats, is marked by the accession of oxygen, which is taken into combination. This increase of the oxygen content permits a calorific deficiency, which, on account of the high anticalorific value of oxygen, is often serious. It is possible that in many cases considerable increase of oxygen and consequent loss of efficiency are suffered by the lower-class fuels between removal from the bed and consumption; and it is probable that in the subbituminous coals, and more especially in the lignites, oxygenation begins immediately after the coal is blasted from the face in the mine.

Bulletin 382 can be had free of charge from the Director, United States Geological

Survey, Washington, D. C.

New York Constructing a Waterway

The Troy, N. Y., Times says:
"The attention of the United States Government is called to the fact that the state of New York is constructing, at its own expense, a waterway from the Great Lakes to tidewater. This canal will accommodate vessels of larger size than any similar waterway this side of the Canadian border, and Uncle Sam can do a graceful act by providing proper facilities for traffic by properly dredging out the river from Waterford down to Hudson."

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The Canal Requires Inland Waterways

In an address at Topeka, Kans., Mr. John Barrett, of the Bureau of American Republics, said: "It will be folly to spend \$4,000,000 on the Isthmian Canal and not a similar amount during the corresponding years in legitimate dredging and improving of the channels of the Mississippi, Missouri, and

their navigable tributaries.

'Let Missouri, Kansas, and their neighboring states, as great industrial and agricultural productive districts, destined to supply the markets of the Pacific as well as those of the United States, support enthusiastically an agitation, a campaign of educa-tion of the people and Congress, which will make our country a leader and not a laggard in the competition for the vast prizes of international commerce upon the Pacific seas.

"The Panama project will be merely a dream if our Government does not improve our inland waterways and make them channels of cheap transportation to the seaboard."
The Capital adds: "For generations Con-

gress may have frittered away millions in desultory and unsystematic river and harbor work, but the new idea of systematic waterway development appeals to the imagination of the country, especially of the West, as no national project that has been proposed in fifty years. It is a project worthy of the immense wealth and energies of the country, a big project, and a big country to carry it out. Mr. Barrett's appeal for try to carry it out. it will not fall on deaf ears in this part of the country.

况 况 况 Artesian Possibilities in Antelope Valley

A brief advance statement of the artesian possibilities of a portion of the Antelope valley region, California, has been prepared by the United States Geological Survey in the United States Geological Survey in response to special requests. The conclusions resulting from the survey's investigation of the region are not favorable to the finding of extensive supplies of underground water. The area embraced in the report is T. 5 N., R. 8 W.; T. 5 N., R. 9 W.; T. 6 N., R. 8 W., and T. 6 N., R. 9 W.

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